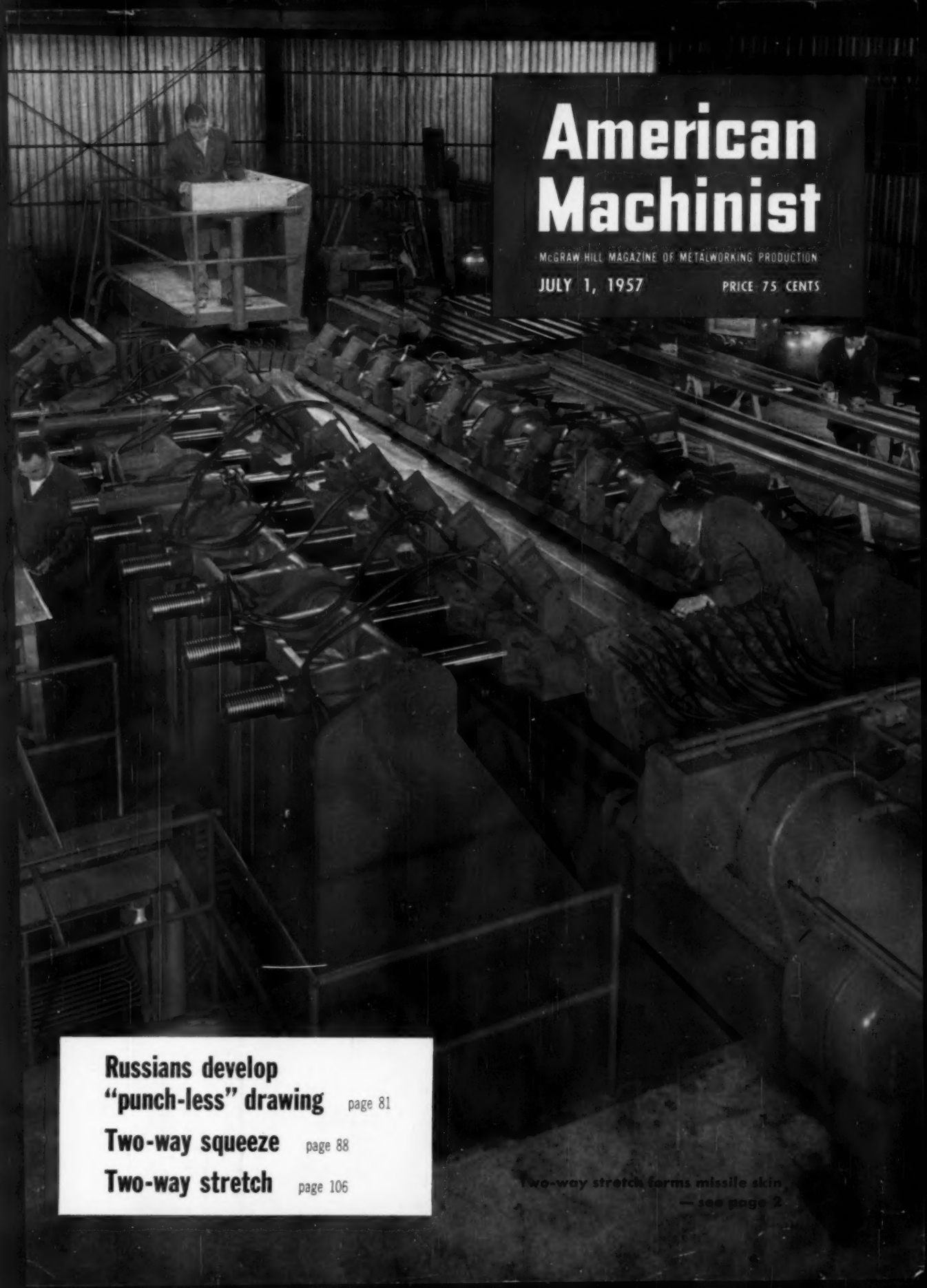


American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

JULY 1, 1957 PRICE 75 CENTS

Russians develop "punch-less" drawing page 81

Two-way squeeze page 88

Two-way stretch page 106

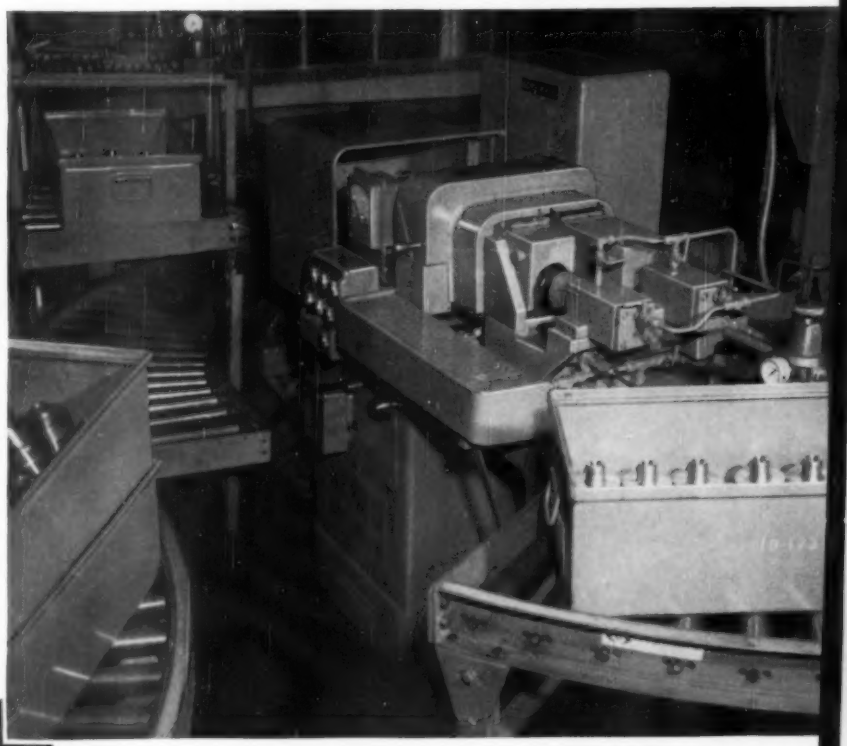
Two-way stretch forms missile skin — see page 2

GUN DRILLING on a Bore-Matic gives

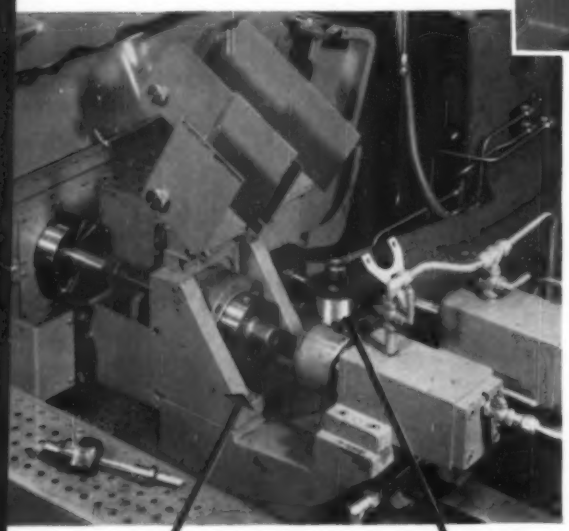
SURE-FIRE PRODUCTION

with

- higher precision
- better finish
- easier operation
- less maintenance
- lower costs



Model 121 Bore-Matic equipped for gun drilling is positioned in a conveyorized production line. Left foreground conveyor brings work to operator and lower background conveyor takes it to intermediate operations. Right foreground conveyor returns work for second gun drilling and upper background conveyor takes pieces away.



FRONT STATION—Gun drill plunger hole from solid. Coolant is confined inside part, after drill breaks through, by Neoprene tip on hydraulic clamping head.

REAR STATION—Gun drill port hole from solid. Holes are plugged to confine pressure (750 psi) coolant inside work after drill breaks through.

THE PRECISION and speed of a Bore-Matic make it a natural for gun drilling. For example, the two-station Model 121 shown here was fitted with adapters to hold the gun drills on the boringhead spindles and with hydraulic clamping heads mounted on the table for the mating bushings. It replaced a two-spindle gun drilling machine for handling the plunger and port holes in Nitralloy hydraulic heads. Here are the results:

PRODUCTION was increased from 24 to 27 parts per hour for plunger hole. Port hole production — previously done on drill press with final location by subsequent grinding of shoulder — went up to 48 parts per hour with *accurate* location.

TOLERANCES were reduced from .002 to .001. Both holes straight within 20 to 30 millionths.

FINISH was improved from 60 rms to 15 rms; and honing was eliminated.

OPERATIONAL handling time was cut in half.

MAINTENANCE was substantially reduced.

COSTS were cut by 75% over previous method.

Another plus factor was that the closer tolerances resulted in great savings in subsequent operations.

For more information on this and other interesting and profitable set-up possibilities with a Bore-Matic, get in touch with your nearest Heald representative.

IT PAYS TO COME TO HEALD!

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

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Hard nickel plating makes molds . . . A tricky way to make molds for plastic parts by silver spraying a master part, then plating on hard nickel and copper. *By Charles Emerson.* **85**

"Two-way squeeze" makes precise parts . . . Compression forming can eliminate handwork to correct springback and distortion. *By F C Hoffman, Lockheed Aircraft Corp.* **88**

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How to pinpoint production operations . . . Here is how you can refine the control ratios described in an earlier article into eight composite controls that will show at a glance how your plant is doing. *By Spencer A Tucker.* **97**

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Milling with carbides I, II . . . A checklist of the steps and a table of starting feeds and speeds. *By John Begle, Futurmill, Inc.* **117**

American Machinist *Chips*

Cover . . .
Skin of the Titan missile built by Martin Denver Division gets a stretch in bi-axial machine built by Hufford Machine Works. For details, see article on page 106.

Three Forming Approaches . . .
Three unusual approaches to metal forming highlight this issue. Each is a radically different approach to the subject and each comes from a different source. There is a new method of stretch forming shown on our cover and described in the article on page 106. There is a discussion of compression forming, the reverse of stretch forming, from Lockheed on page 88.

Oddest approach is the report on the Russian method of "punch-less" forming that we have developed from our continuing study of Soviet publications. In this method a rubber ring under the flange to be deep drawn is compressed. As the ring flows under pressure the friction between the ring and the flange flow the metal toward the center and pushes it up into the cavity. The Russians concede that a punch helps, but maintain that the operation can be performed without the aid of a punch.

We have been debating the Soviet article and studying the merits of the method. (The same soul-searching went on in our offices before we published the first report on ceramic tools some years ago, and on electrical discharge machining before that.) Rupert LeGrand has carefully consolidated the information into the article you will find on page 81. We urge you to study it. We'll be interested in your reaction to the method, and if the article moves you to make any investigations or tests, we'd like to hear how they work out.

If there is a single key to the techniques used by management consultants, it lies in the development of composite control ratios. Our current article by Spencer Tucker, page 97, tells how you can do it yourself.

Coming . . . Prepare for a shock. *AM* for July 15 will arrive on your desk wearing a most unusual front cover. Inside you will find a summary on what has been happening in numerical control of machine tools and on how you can apply these developments to your production. This report will be a worthy sequel to our original Special Report that is still widely used as a basic source of information on this new subject. To do justice to the report we commissioned one of our country's leading artists, well known for industrial work, to paint the front cover. The ingredients were titanium, epoxy resins, a study of the subject, and talent. The result may startle you within an inch of your life, but we wager it will grow on you and impress you with its coverage of the elements that go into numerical control. Elsewhere in the same July 15 issue you will find articles on a successful and practical replacement program, an unusual cutoff method, suggestions on using coated abrasives, drawing titanium, how one plant set up a production control center, plus several others.

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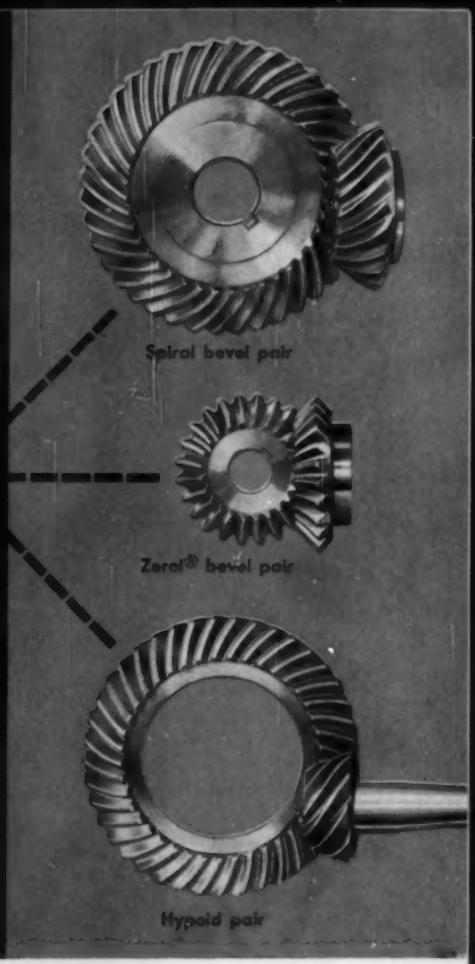


One cutter produced these three gear pairs!

The new Gleason No. 116 Hypoid Generator used *one* Unitool* Cutter to generate the three gear pairs shown above. Only five additional Unitool Cutters are needed on this generator to cut spiral and Zerol® bevel gears of any ratio, and hypoid gears of 3:1 ratio and higher; up to 18″ pitch diameter.

The Unitool Method was developed especially for use with the No. 116 Hypoid Generator, and its smaller counterpart, the No. 106 Hypoid Generator. This new method requires only a small tooling cost to cover the entire range of both machines.

It is intended for the production of small quantities of bevel and hypoid gears, and does not replace the cutting methods now in use for mass production. When using these methods, the No. 116 Generator is substantially faster than previous models.

In addition, the new features incorporated on the No. 116 offer simplification of tooth bearing development, improved quality, and much easier setup and operation.

We shall be glad to send more information on the No. 116 Hypoid Generator and the Unitool Method for producing small quantities of bevel gears.

** Trademark*

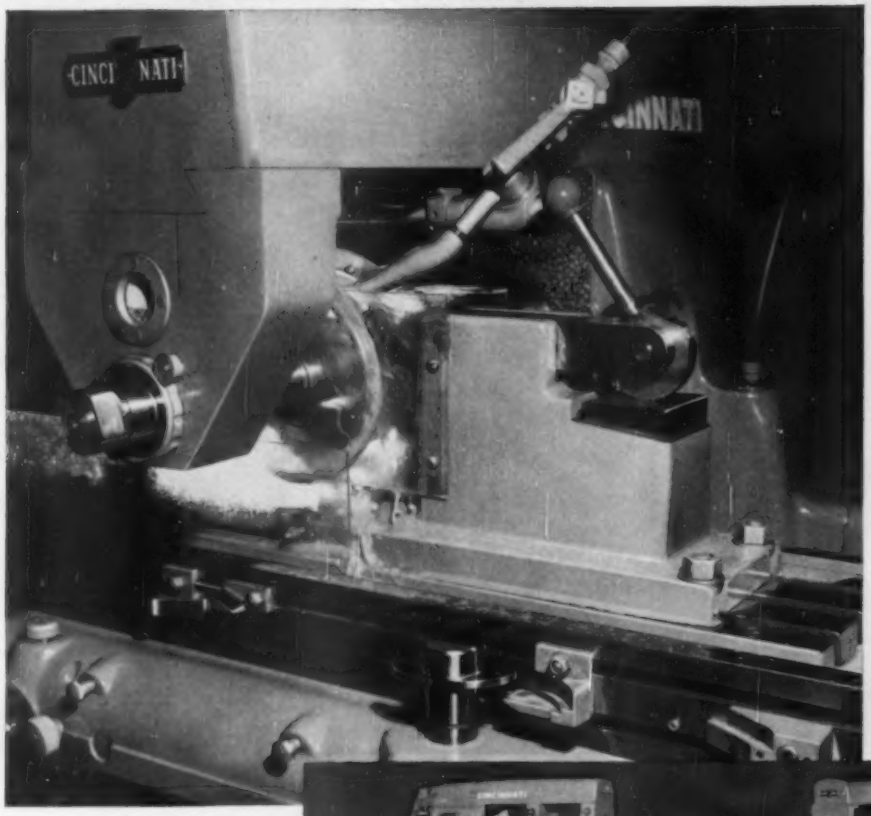
GLEASON WORKS

Builders of bevel gear machinery for over 90 years

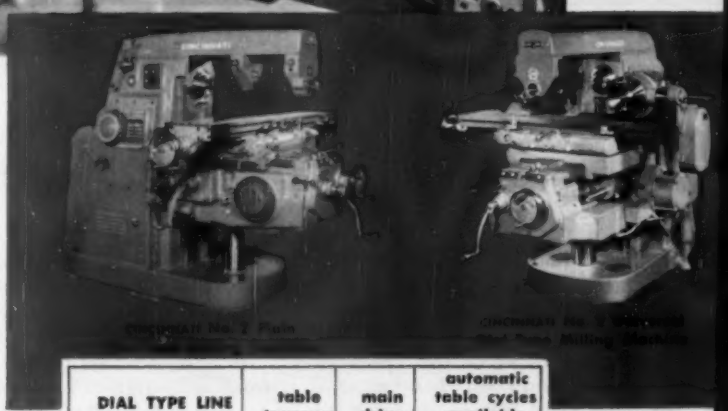
1000 UNIVERSITY AVE., ROCHESTER 3, N. Y.

The No. 116 Hypoid Generator cuts spiral bevel, Zerol bevel and hypoid gears up to 18″ pitch diameter, any ratio up to 10:1, any pitch 2 DP and finer.

CINCINNATI DIAL TYPES



Automatic milling, using a simple one-way feed cycle, on a CINCINNATI No. 2 Plain Dial Type Milling Machine with Automatic Table Cycles

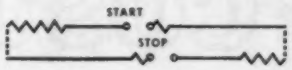


DIAL TYPE LINE		table traverse	main drive	automatic table cycles available
No. 2	Plain	28"	10 hp	yes
	Universal			no
	Vertical			yes
No. 3	Plain	34"	15 hp	yes
	Universal			no
	Vertical			yes
No. 4	Plain	42"	20 hp	yes
	Universal			no
	Vertical			yes

CINCINNATI

MILLING MACHINES • BROACHING MACHINES • CUTTER AND TOOL GRINDERS • METAL FORMING MACHINES

...for Automatic Milling



One of many automatic table cycles available

For widely varying manufacturing quantities from toolroom lots to several hundred, Dial Types with **automatic table cycles** are ace high in keeping costs down. By merely setting the dogs at the front of the table, any feed and rapid traverse combination of three basic cycles is obtainable: feed right... feed left... alternately left and right; continuously or with center safety stop. Of course, standard features of versatility are retained in these machines. Available in Nos. 2, 3 and 4 sizes; plain and vertical styles.

...for Toolroom Milling

For uniformly low manufacturing quantities, **Dial Types with conventional table cycles** will be your first choice. They are available in Nos. 2, 3 and 4 sizes; plain, universal and vertical styles; standard (2½" to 100") or short lead (.010" to 1000") range for the universal machines.

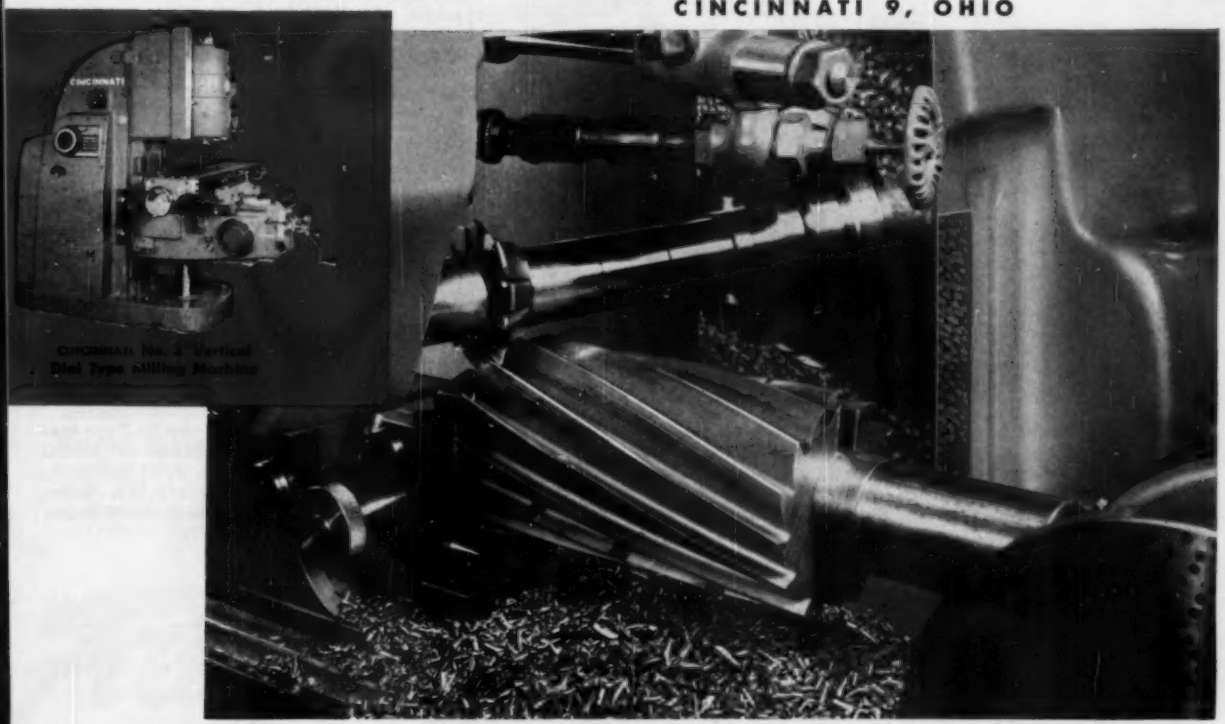
CINCINNATI

Compare CINCINNATI® Dial Type Milling Machines with any other in the 10 to 20 hp classification. In no other machine will you find the advantages of standard features such as:

Automatic backlash eliminator... Dynapoise overarm... push-button spindle speed selection... 24 spindle speeds, 100 to 1 ratio... 32 feeds, ⅜" to 90" per minute... automatic disengagement of all hand cranks... 150" per minute power rapid traverse... choice of automatic or conventional table cycles.

A complete list of Dial Type advantages and specifications is contained in catalog No. M-1915-2. May we send a copy to you? Brief specifications will be found in Sweet's.

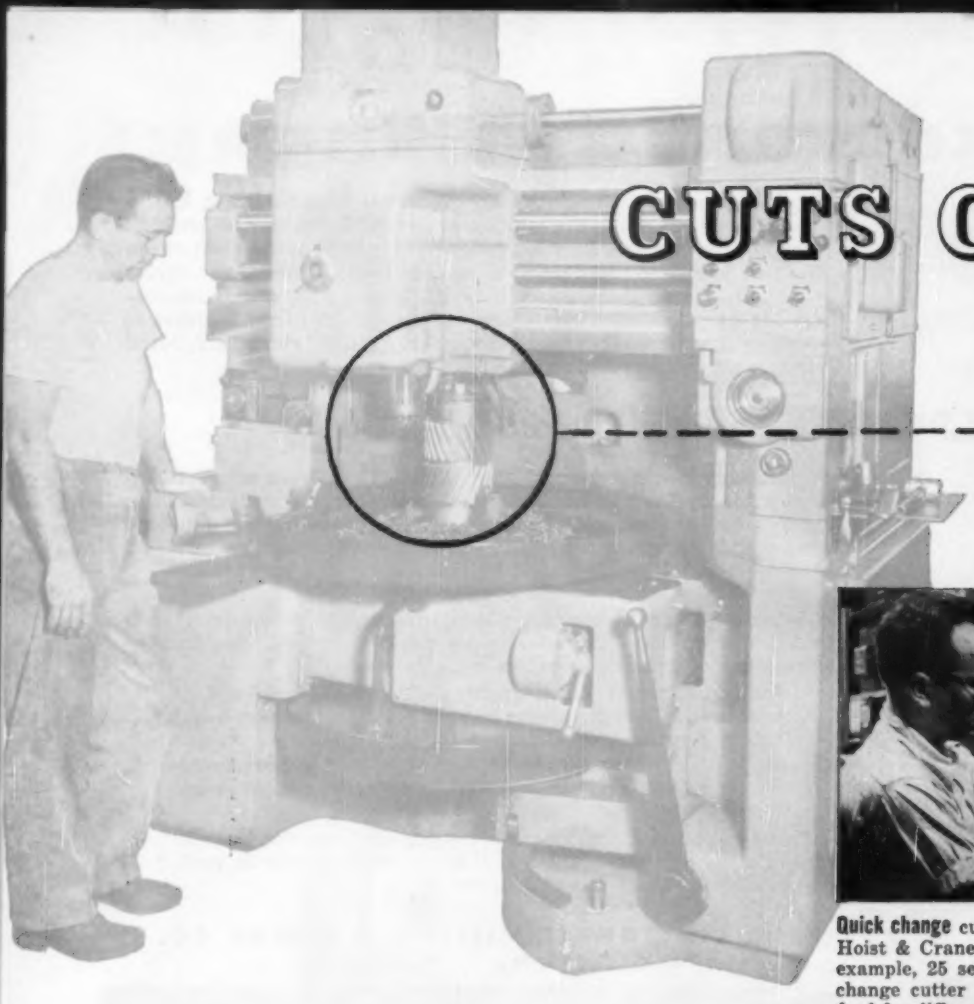
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO



Toolroom milling operations, such as this helical milling setup, are performed at exceptionally low cost on CINCINNATI Dial Type Milling Machines

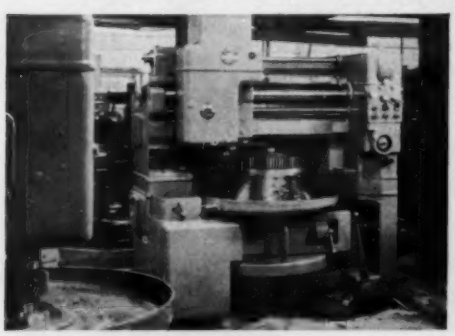
HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID • GRINDING WHEELS

CUTS COSTS



Quick change cuts costs on short runs: at Silent Hoist & Crane Company, Brooklyn, N. Y., for example, 25 seconds is all the time needed to change cutter speed, depth of cut and rotary feed for different sized sprockets.

Five times faster than the machines they replaced on a variety of jobs, 36-Type Gear Shapers set many cost-cutting records at New Process Gear Co., Syracuse, N. Y. Part shown cut in one operation. Rate: 135 finished per day.

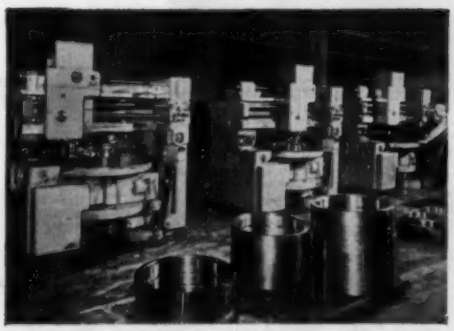


Faster on gears up to 36" P.D., two 36-Type machines replaced *five* older machines at Samuel M. Langston Co., Camden, N. J. 22.250" P.D., 4 D.P. steel spur shown is cut in 2½ hours. Production time on previous machine—10 hours.

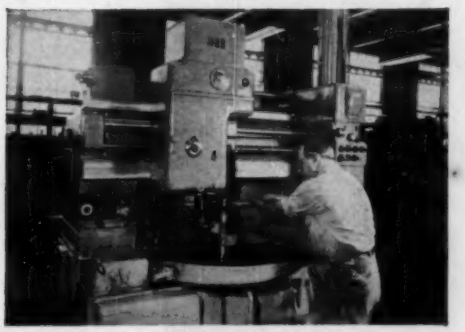
THE PRECISION LINE

5 WAYS

FELLOWS 36-TYPE GEAR SHAPER



Heavy cutting power: 36-Type Gear Shaper removes 93 cubic inches of stock (26 lbs.) from the blank in just two cuts to make this 25.3" P.D., 3 D.P. gear at Fairfield Manufacturing Co., Lafayette, Ind. Total time: 258 minutes.



More efficient small gear cutting, too: 57 minutes is all it takes to cut each hand of this 6.486" P.D., 5/7 D.P.; 23° H.A., herringbone pinion at Snow-Nabstedt Corporation, Hamden, Conn., on their 36-Type Gear Shapers.

Here's the way to lower gear production costs even though over-all costs keep rising! These major firms (and many others) have proved that fast, accurate Fellows 36-Type Gear Shapers have the power, speed and versatility to cut production costs . . . often by more than 50%!

Set-ups are fast and simple for a wide range of jobs up to 36" P.D. Cutter speeds from 18 to 300 strokes per minute are available through a selector dial. Four rotary feeds are available through a feed lever, additional feeds through two pick-off gears. Semi-automatic fixtures may be used to decrease loading time.

Whether for long runs or many varied jobs, the powerful, versatile Fellows 36-Type Gear Shaper can very probably lower *your* gear production costs. Your Fellows Representative can give you valuable facts and figures about the benefits of investing in the Fellows Precision Line of gear production equipment. Write, wire, or phone any Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 N. Woodward Ave., Royal Oak, Mich.
150 West Pleasant Avenue, Maywood, N. J.
5835 West North Avenue, Chicago 39
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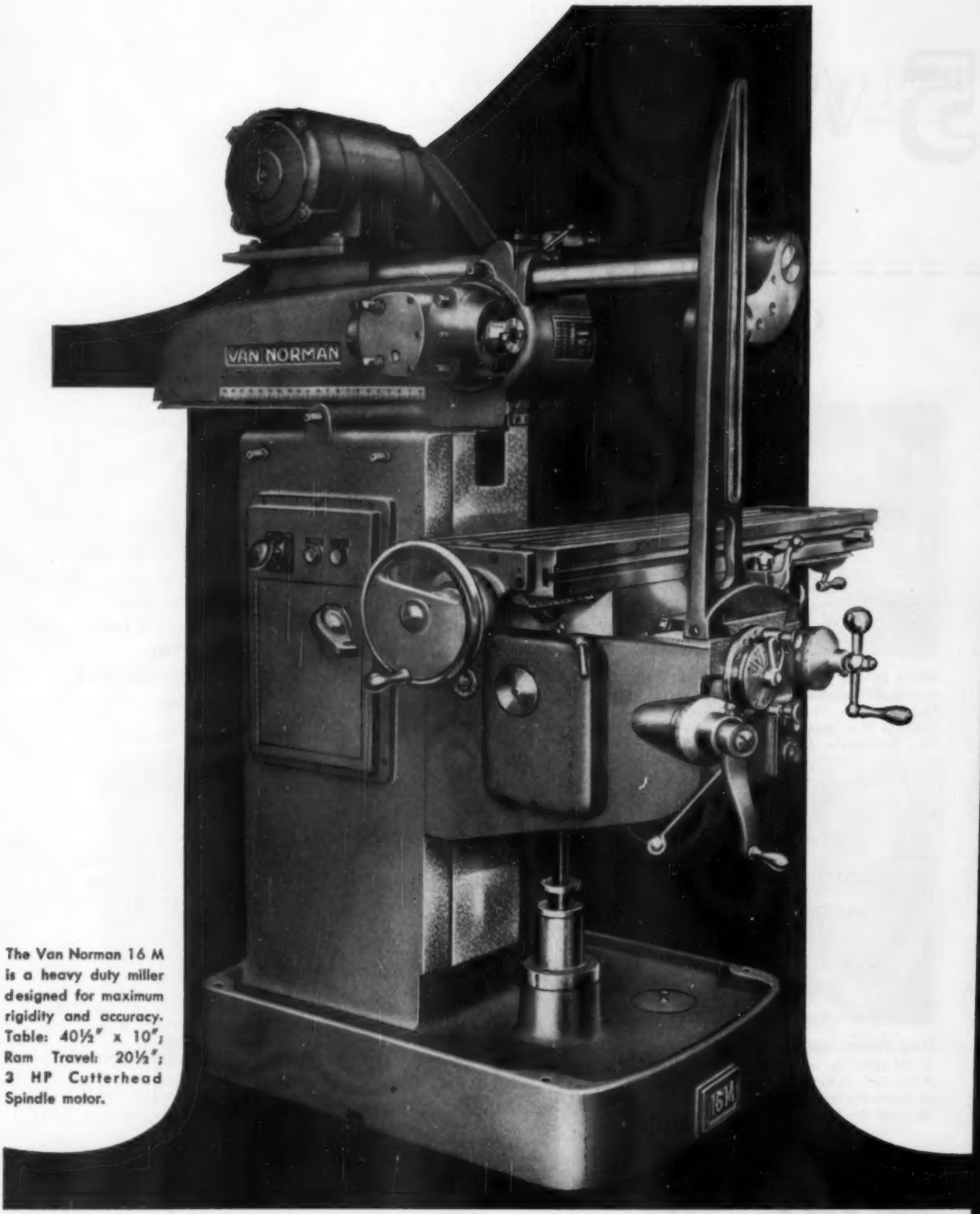
Fellows *Gear Production Equipment*



The Van Norman 16 M is a heavy duty miller designed for maximum rigidity and accuracy. Table: 40½" x 10"; Ram Travel: 20½"; 3 HP Cutterhead Spindle motor.

VAN NORMAN MACHINE

A DIVISION OF VAN NORMAN INDUSTRIES, INC.

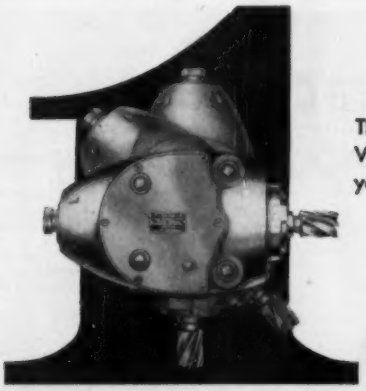
MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

ONE VAN NORMAN

Ram-Type Miller

Does the Work of 2 Conventional Millers

Boosts Production . . . Saves Dollars!



This adjustable cutterhead, standard equipment on the Van Norman 16 M, gives you two millers in one. It enables you to do horizontal, angular or vertical milling.

Designed to increase your production and reduce your costs, Van Norman Ram-Type Millers are engineered for maximum cutability, accuracy and rigidity. With a Van Norman Ram-Type Miller, *one* initial investment in *one* machine gives you the equivalent of two conventional millers, also eliminates the need for many costly attachments and special tooling.

Get complete specifications on entire line of Van Norman Ram-Type Millers. Write, wire or telephone for catalog.

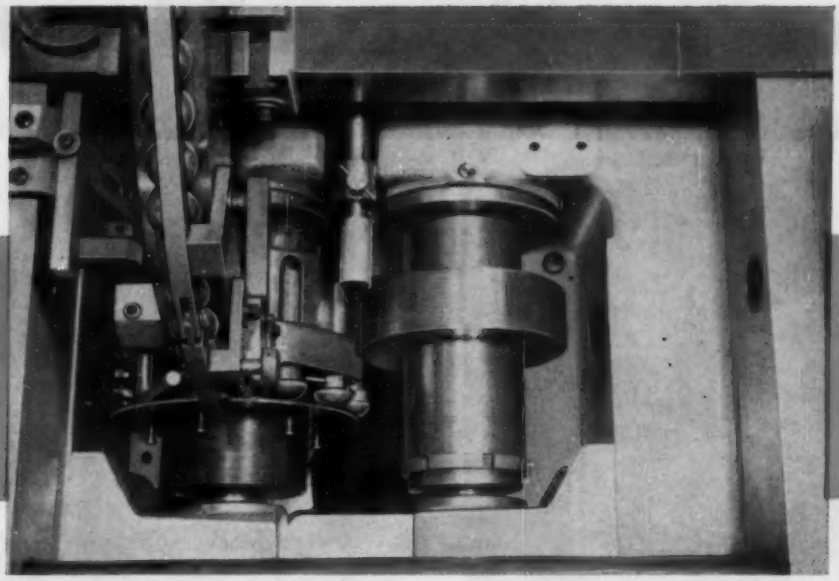
COMPANY

SPRINGFIELD 7, MASSACHUSETTS

Don't wait . . . for extra profit install a Van Norman machine now! They are available in many purchase plans . . . Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate up to 10 years. Conditional Sales Contracts not available to Export.

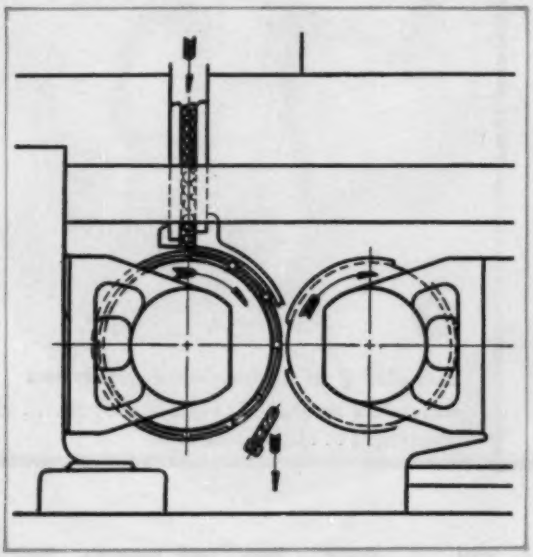
AUTOMATED THREAD ROLLING

with the LANHYROL machine



The automatic features of the LANHYROL Thread Rolling Machine have enabled a large industrial fastener and related parts company to automate its process for producing button head oval neck track bolts. ¾" 10 pitch UNC threads are rolled 1¾" in length to Class 2A fit.

One man now handles the entire operation, eliminating difficult and costly handling of hot-forged bolt blanks required in the old process. Now . . . bolt blanks are cold-formed from 800-lb. coils of hot-rolled steel wire by passing through a wire-drawer into a two-blow header, conveyed to a hopper, threaded by Continuous Rolling on the LANHYROL Machine, and ejected as finished parts into a bin for removal.



Continuous Rolling (illustrated) is one of three thread-rolling methods utilized by the LANHYROL Machine. Blanks are delivered from a hopper to an automatic, indexing-type workrest. This indexes the pieces according to a preset cycle into and away from the rolling position. There, thread-rolling is accomplished by two opposed cam-type rolling dies.

Although the LANHYROL is capable of rolling 80 track bolts per minute, in this application it is only operated to slightly exceed the production rate of the header which is 60 blanks per minute. Thread finish is considerably improved over previous methods and roll life is excellent . . . more than ¾ of a million bolts have been threaded to date with the original roll dies.

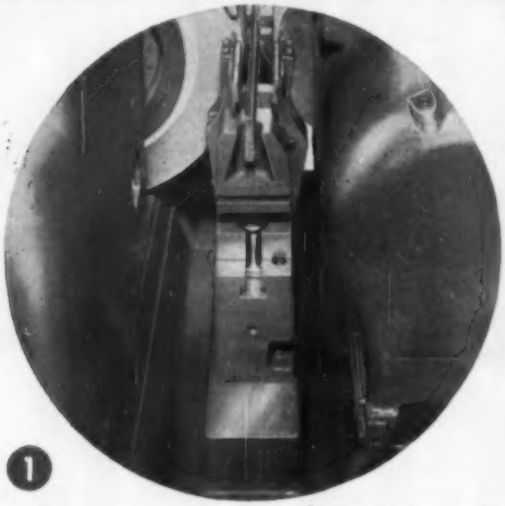
The LANHYROL Machine produces excellent threads at unequalled rates of output, and its method of operation fits well into automated processes. For information on its unusual range and flexibility, and the Infeed and Thrufeed thread rolling methods, send specifications and ask for Bulletin E-60.

493C

LANDIS Machine COMPANY

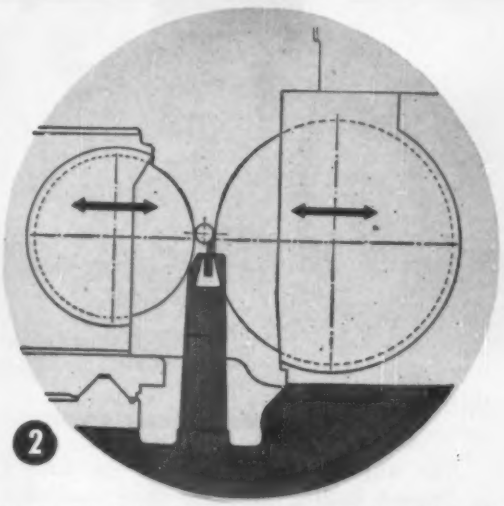
WAYNESBORO • PENNSYLVANIA • U. S. A.

4 reasons why Landis centerless



1

"Rigid" work rest Solid support permits extra heavy cuts without loss of accuracy or finish.



2

Landis method of centerless grinding Work positioned on rigid work rest—Grinding and Regulating Wheel Heads slide on hand scraped ways.

3

Completely adjustable regulating wheel head

a. Tilt adjustment
b. Swivel adjustment
c. Wheel feed handwheel
d. Wheel aligning screw

4

***Both* grinding and regulating wheel spindles have Microsphere bearings** For fast spark-out . . . close tolerances . . . fine finishes

LANDIS

precision grinders

grinders lower production cost

No. 12 Centerless Grinder

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

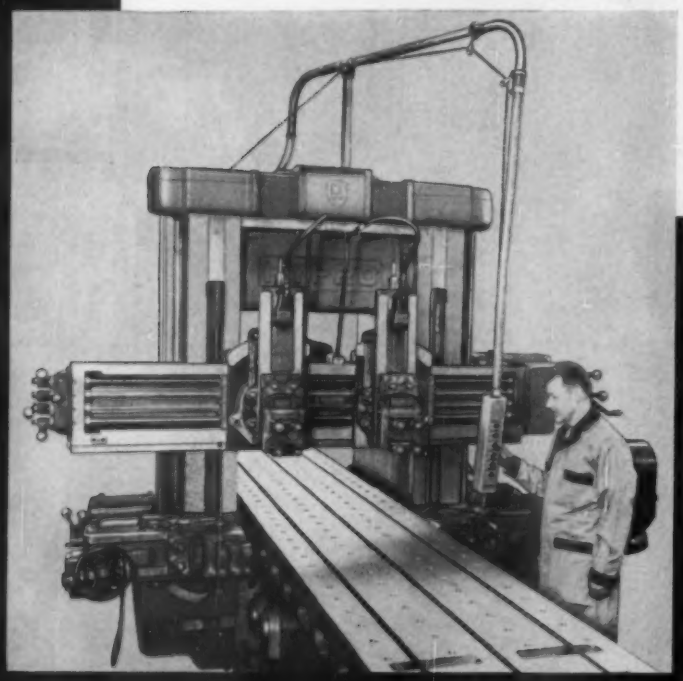
Giddings & Lewis
HYPRO DOUBLE HOUSING PLANERS

PROVEN Giddings & Lewis HYPRO double housing planer features offer you utmost rigidity for heavy duty machining with either high-speed steel or carbide tools . . . up to 400 surface feet per minute.

What's more, the *dual rail controls* enable you to select feeds and *rapid traverse* from either side of the machine. Adjustable cut and return speeds permit the right selections for all cutting conditions. The *patented electric dial feed* is easily adjustable over a wide feed range. *Power rapid traverse* to all heads, complete with direct current braking, assures close-positioning control. The extra depth, one-piece rail and double length, enclosed bed provide additional strength and rigidity for high-speed planing of large workpieces.

These progressively engineered Giddings & Lewis HYPRO double housing planers are offered in 23 standard sizes, in work capacities from 30" to 144" widths . . . to any length desired. Motor drives range from 25/50 through 100/200 hp, assuring ample power to plane at speeds up to 400 fpm. Machines can be furnished with choice of 1, 2, 3, or 4 heads. Special frog and switch, as well as die block models, in complete line are also available.

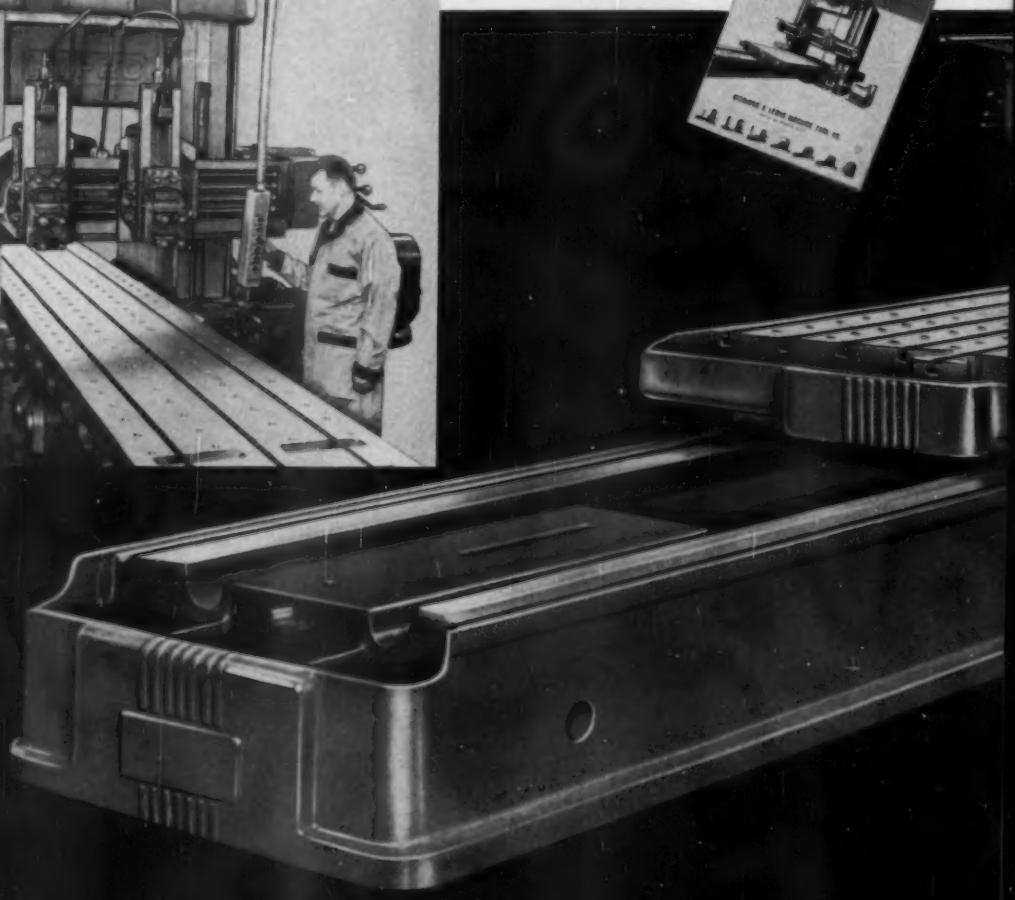
For more information on G&L and HYPRO double housing or openside planers, contact your nearest Giddings & Lewis representative, or write direct.



HYPRO 36" x 36" double housing planer at left.

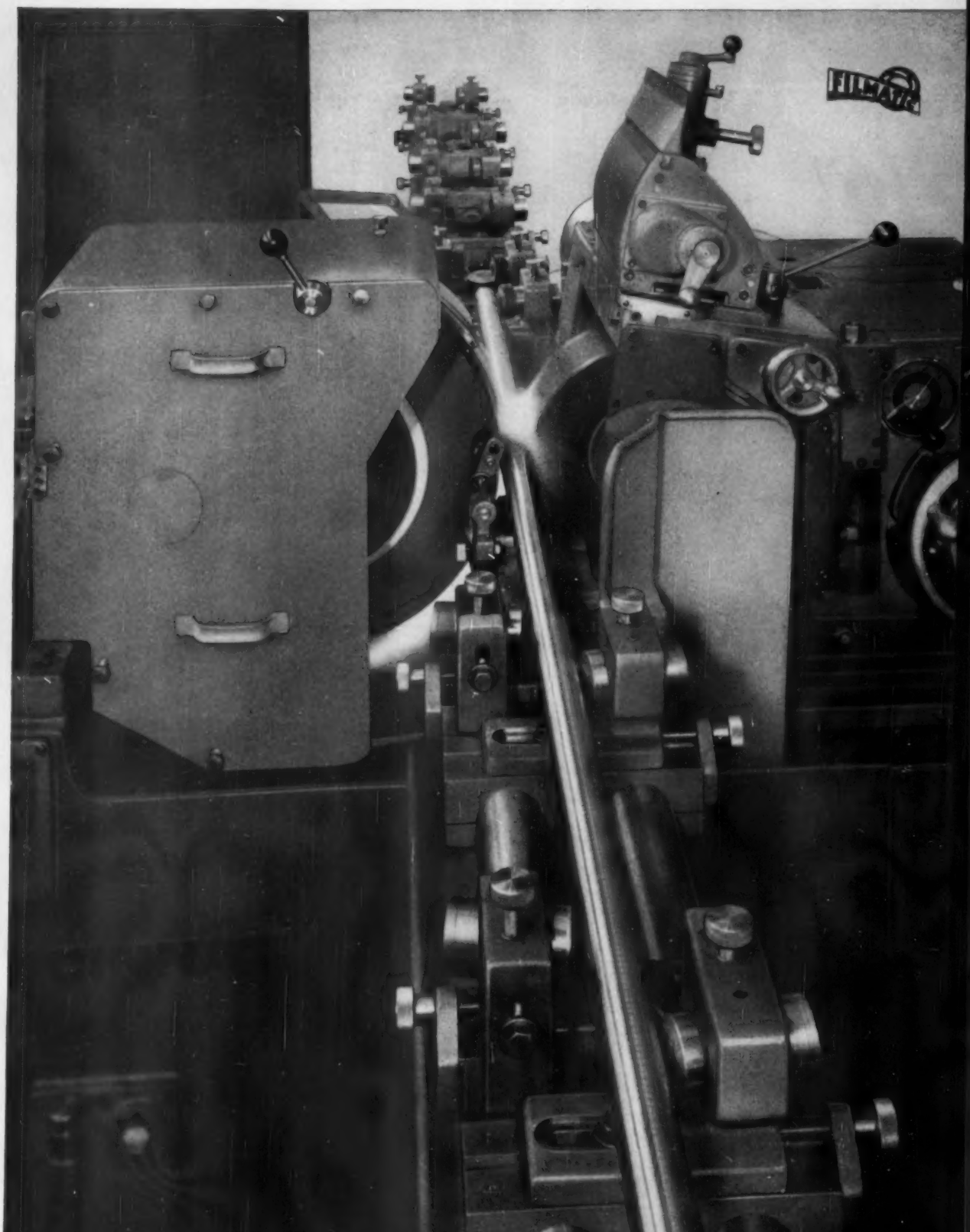
HYPRO 144" x 144" double housing planer at right.

For complete specifications on double housing planers, write for Bulletin No. 250.



G & L *and* HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN G-76

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines, and VARIAX Milling Machines.



CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE

Cincinnati Filmatic No. 3's...Make Your Tough Centerless Grinding Jobs Look Easy and Cost Less

Thrufeed grinding 4" steel bars, or infeed grinding multiple diameter spindles up to 20" long are tough jobs for any centerless. CINCINNATI® FILMATIC No. 3's make these jobs, and thousands of in-between sizes and shapes, look easy and cost less. The No. 3's are extra powerful to give you extra productive capacity combined with Cincinnati's well-known dependability of performance. Contributing factors to these desirable elements of low production costs include:

1) **Fixed bedrock mounting of the grinding wheel spindle for fast, economical grinding**
2) **FILMATIC grinding wheel spindle bearings for highest quality performance and zero maintenance. They're self-adjusting for every job**
3) **Pre-loaded, precision anti-friction regulating wheel slide, for super-precise size control**
4) **Infinitely variable regulating wheel speeds ranging from 10 to 320 rpm, for quick selection of the correct speed**
5) **Automatic grinding wheel balancing (supplied at extra cost)**

Eleven additional features and their relation to the proved dependability and productive capacity of CINCINNATI FILMATIC No. 3 Centerless Grinders are outlined in catalog No. G-664-1. Ask for a copy today. You will find brief data in Sweet's Machine Tool File.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

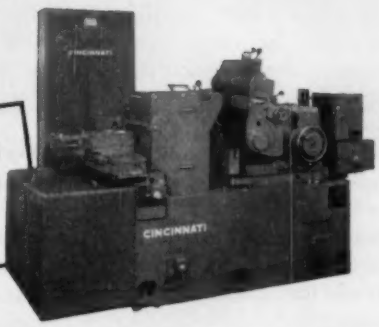
CINCINNATI

Solid steel bars, up to 4" diameter x 18 feet long, are ground on a CINCINNATI FILMATIC No. 3 Centerless Grinding Machine equipped with Type D Long Bar Grinding Attachment.

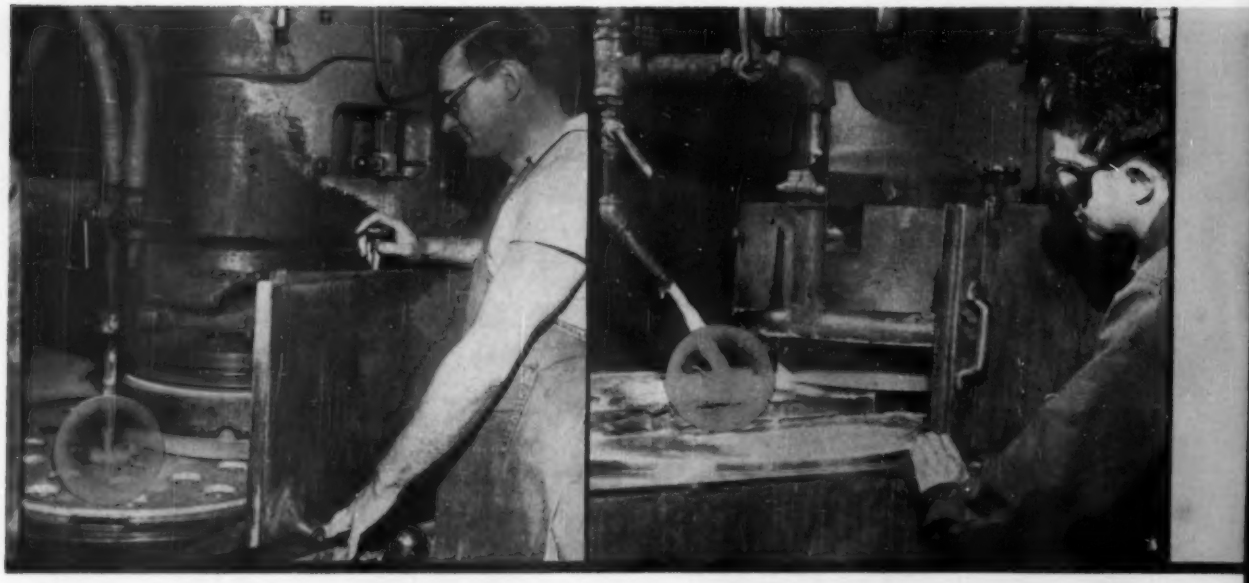
Up to 20" length can be infeed ground to size pass on new CINCINNATI FILMATIC No. 3 Centerless Grinding Machines. In the setup above, 4-, 5- or 6 diameters, within overall lengths of 16½", are infeed ground on stainless steel bolts.

CINCINNATI

CINCINNATI FILMATIC No. 3
Centerless Grinding Machine
Catalog No. G-664-1



GRINDING MACHINES • CHUCKING GRINDERS • MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES



When you surface grind with segments

Take advantage of this COMPLETE Line

... and add the profit-boosting "Touch of Gold" to any surface grinder

You can be sure that switching from grinding wheels to Norton abrasive segments brings powerful, profit-building "Touch of Gold" benefits to very many jobs.

Because —

Norton makes segments in every required shape and size and in exactly the right abrasive and bond for best results in the widest variety of surface grinding — on ferrous and non-ferrous metals and on work pieces ranging from boiler plate to the hardest die steels, die sets or blocks.

Norton segments are made in many ALUNDUM* abrasives. Of these, 32 ALUNDUM abrasive is particularly suited for fast stock removal and heavy feeds. 37C CRYSTOLON* abrasive, unequalled on hard cast iron and soft non-ferrous metals, is also available. And diamond segments are also furnished, if desired, for ceramics, quartz and glass.

Bonds include the G and BE — both vitrified — as well as resinoid bonds. Structure can be either regular or the open (induced pore) which is especially advantageous for many jobs. In the field of surface grinding, users have reported that the G Bond — most efficient vitrified bond ever developed — results in new speed and economy.

With this broad range of abrasives and bonds to choose from you can count on much faster production rate at considerably lower costs. And when you mount these cost-cutting segments in Norton chucks — designed to fit several machines — you safeguard performance and profits.

Ask Your Norton Distributor for the booklet, "The A.B.C. of Surface Grinding." Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

W-1802

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

NORTON

ABRASIVES

Making better products . . . to make your products better

NORTON PRODUCTS

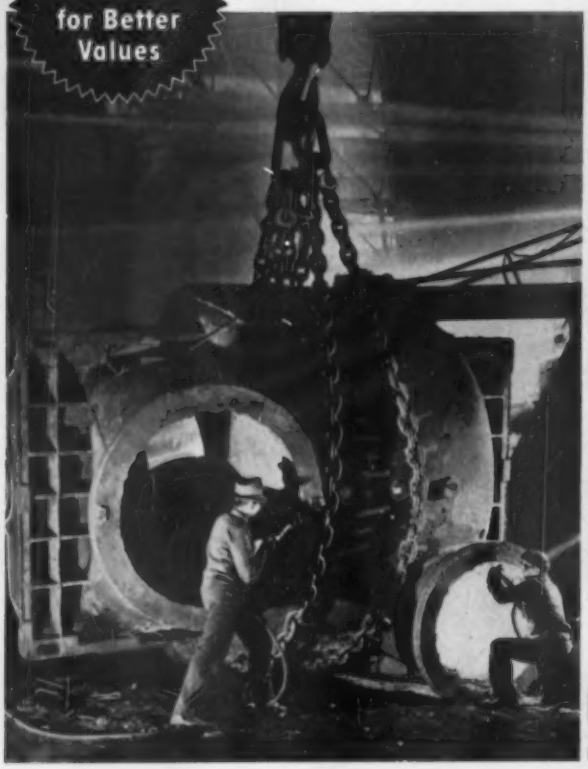
Abrasives • Grinding Wheels
Grinding Machines • Refractories

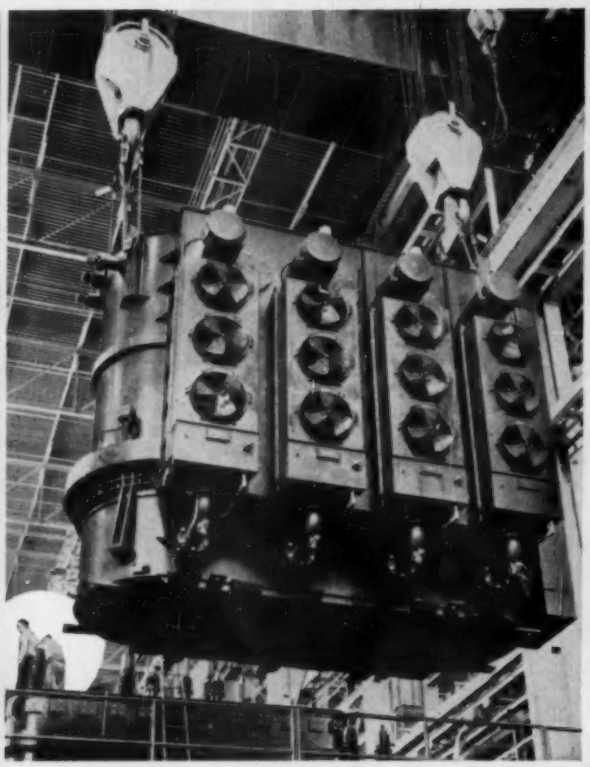
BEHR-MANNING DIVISION

Coated Abrasives • Sharpening Stones
Behr-cat Tapes

ACCO for Better Values

Acco Registered® Slings–Chain or Wire Rope





Why different loads require different slings

Your rigger knows that different loads need different slings because of varying factors such as shape, weight, material, finish, protruding sharp corners, extremes of temperature.

On some jobs chain is best. On others the characteristics of wire rope make it the first choice. On still other jobs, wise riggers know that combinations of chain and wire rope will provide the greatest lifting economy.

No matter what type is called for, you can be sure of the safest slings and the best values in ACCO *Registered* Slings. From this one source you can get unbiased information based on actual know-how.

And you can get the exact slings your rigger should have.

One of the recent improvements is the new shaped Master Link now provided without extra cost on all ACCO *Registered* Slings, chain or wire rope. This link gives 18% greater resistance to distortion with no increase in weight. It is another reason why ACCO *Registered* Slings are recognized as the standard of efficiency and safety.

All ACCO *Registered* Slings are proof-tested, registered and identified for your greater assurance of safety.

• • •

Tell your distributor you'd prefer ACCO *Registered* Slings.

WHAT "ACCO REGISTERED" MEANS

1. The best material
2. Unit safety factor (on bodies, rings, links, hooks)
3. Proof test of complete sling to twice the working load limit
4. Actual field service test of each design
5. Metal identification ring or tag on each sling
6. Signed Registry Certificate with each sling

AMERICAN CHAIN & CABLE
BRIDGEPORT, CONN.

ACCO

Atlanta, Boston, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Wilkes-Barre, Pa., York, Pa.
In Canada: Dominion Chain Co., Ltd., Niagara Falls, Ont.

BH Bond cuts grinding costs in rough snagging operations

Gardner's new BH Bond gives:

longer disc life
BH Bond is tougher, more heat-resistant

higher production
eliminates frequent disc changing

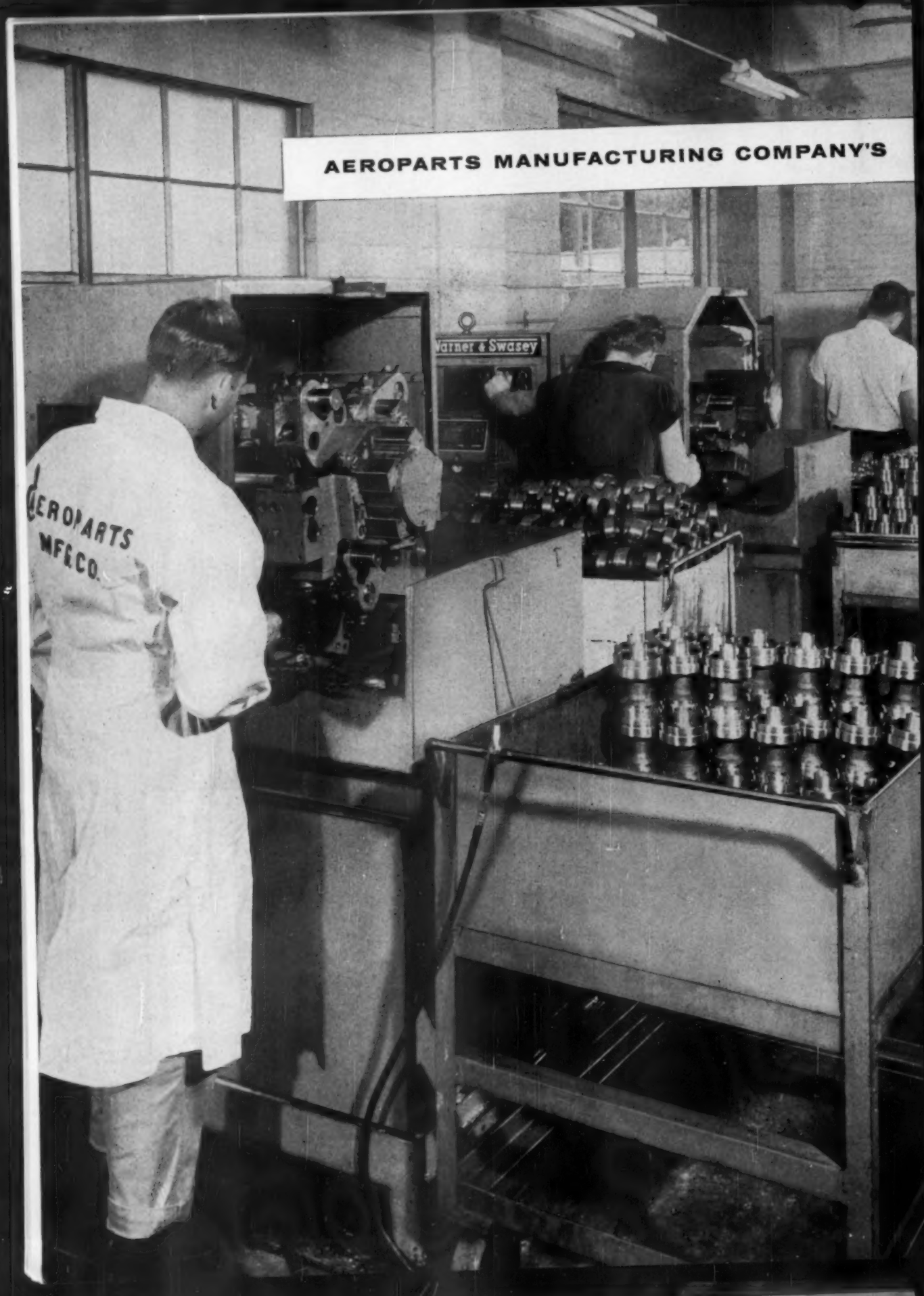
greater efficiency
more production per disc

BH Bond can be supplied in all standard disc sizes

GARDNER

abrasive discs

BELOIT, WISCONSIN


AEROPARTS MANUFACTURING COMPANY'S
Warner & Swasey
AEROPARTS
MFG.CO.

RECIPE FOR SUCCESS

Take on the Tough jobs put them on a Warner & Swasey

R. E. Radford started his company in Tulsa, Oklahoma, in 1943 with a $350.00 investment. Today, his new 40-man plant does sub-contracting on a national scale with a reputation for price and quality.

But, success was not immediate. Even as late as 1952, business prospects looked dim. Then, a man's resourcefulness plus a new kind of machine teamed up to start a literal chain reaction of success. Here's how it happened.

Radford had the idea that there was a profitable future in taking on the tough jobs that were not desirable to other companies. He also had faith to back his convictions. Now all he needed was the right machine to do the job . . . his search was a short one . . . the new Warner & Swasey 1 AC looked like the machine.

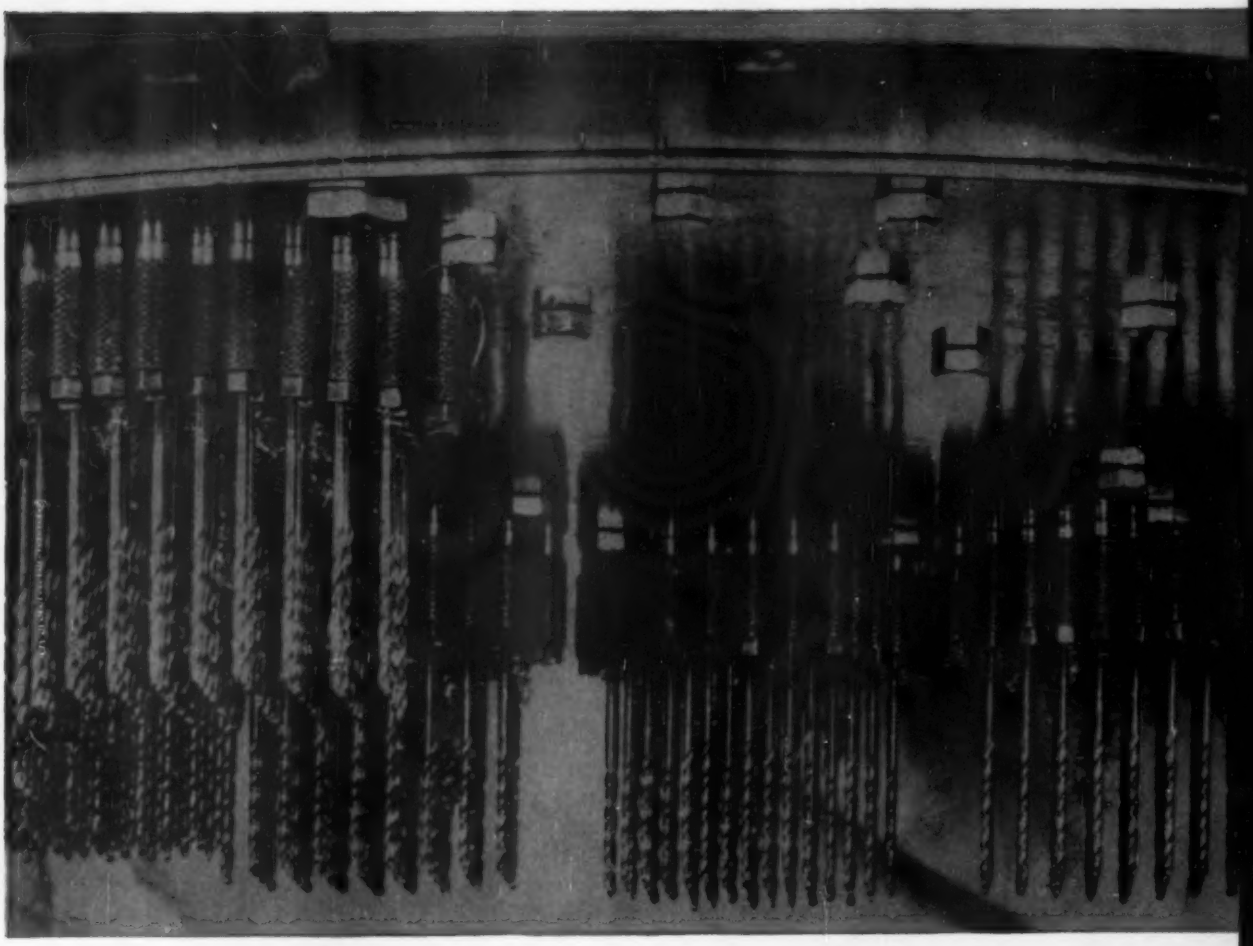
This new single spindle chucker allowed him to expand from his former policy of making screw machine parts to one involving larger, more complicated work . . . permitted him to run short cycle jobs at close tolerances of .001" and less . . . hold micro-inch finishes down to 20 RMS . . . make full use of the machine's late cross slide, flexible tooling characteristics. The dependability of this machine impressed him as much as did its productivity.

These advantages, and others that soon reflected themselves in increased values rendered to his customers, brought more business. So, another Warner & Swasey 1 AC was installed in 1954 and a third in 1955.

Today, men and management at Aeroparts maintain their high regard for their Warner & Swaseys. And in "Tex" Radford's words, "These machines were integral in the growth of this company!"

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS
. . . WITH A WARNER & SWASEY

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880



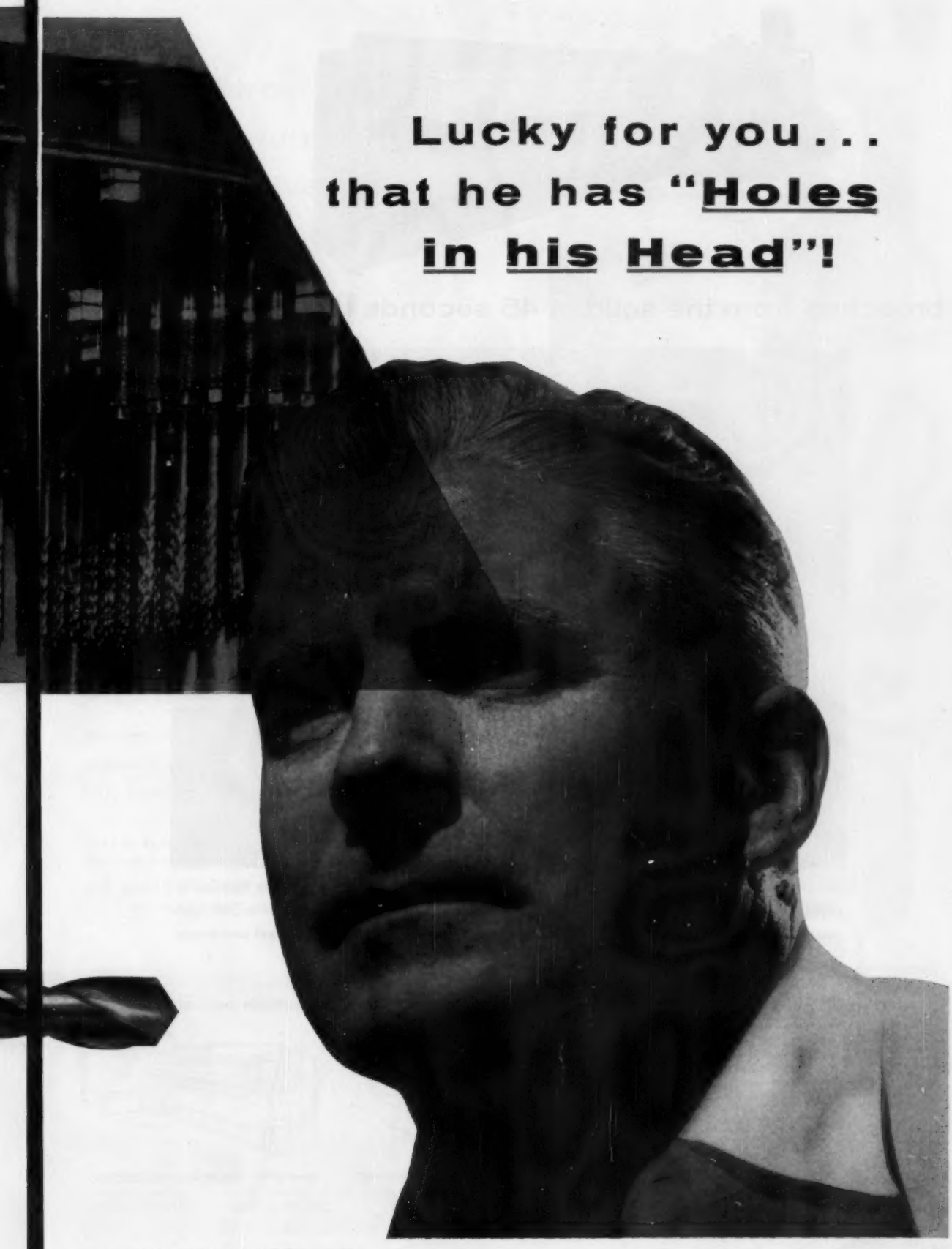
That's all this man thinks about . . . millions of swiftly, cleanly drilled holes in metal . . . and how to deliver them to *you*, on your particular job . . . at lowest possible cost.

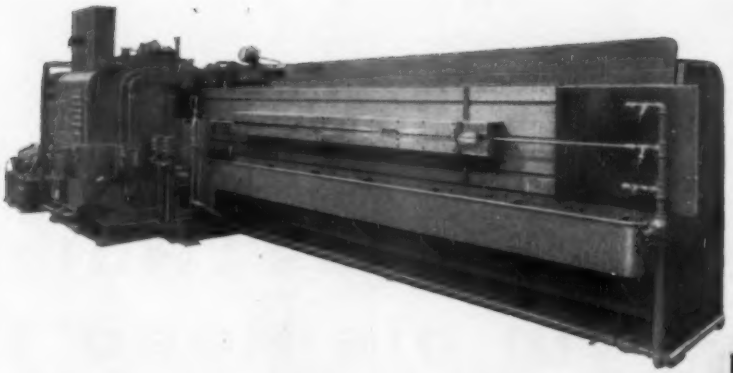
And he's the man who can do it . . . because he's backed by the best engineering brains in the cutting tool industry . . . by the most complete line . . . by the most modern plant . . . and by an international teletype and telegraph network to expedite deliveries.

HE'S THE *MORSE-FRANCHISED DISTRIBUTOR*. AND HE'S AT YOUR SERVICE, NIGHT AND DAY!

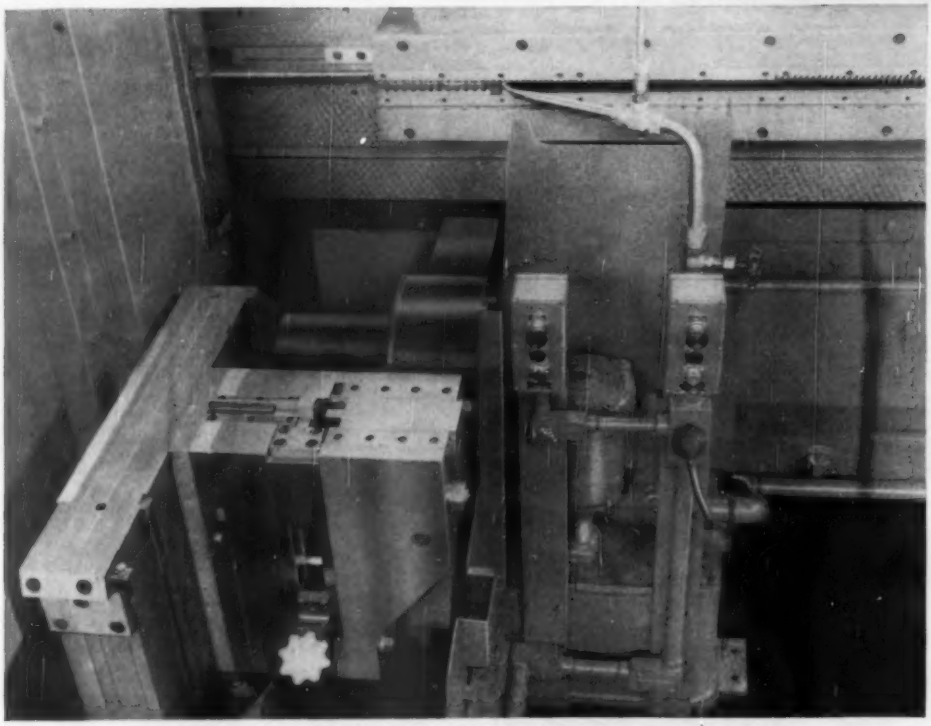
MORSE TWIST DRILL & MACHINE COMPANY
NEW BEDFORD, MASS.
A Division of VAN NORMAN INDUSTRIES, INC.
Warehouses in New York, Chicago, Detroit, Dallas, San Francisco
Buy them by phone from your Morse-Franchised Distributor and save ordering time

another reason why **MORSE**
means **"THE MOST"**
in Cutting Tools


Lucky for you...
that he has "Holes
in his Head"!

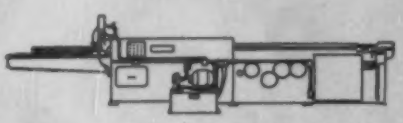


broached from the solid in 45 seconds by LAPOINTE

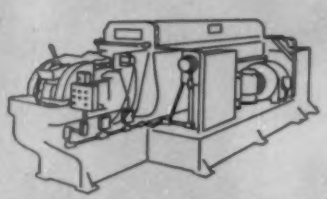


This is the fixture designed and built by Lapointe. The broaching machine has the well-known Lapointe Electro-Motive drive, and operates at variable broaching speeds, from 10 to 100 feet-per-minute. On this job it was found that optimum results were obtained at 60 feet-per-minute.

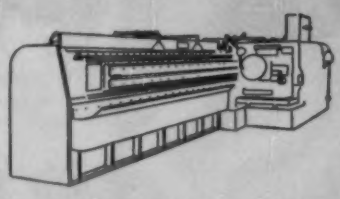
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE



60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC



SRHE SINGLE RAM HORIZONTAL, ELECTRIC

the "pine tree" form on this big steam turbine bucket has the equivalent of a ground finish after being

– BROACHING

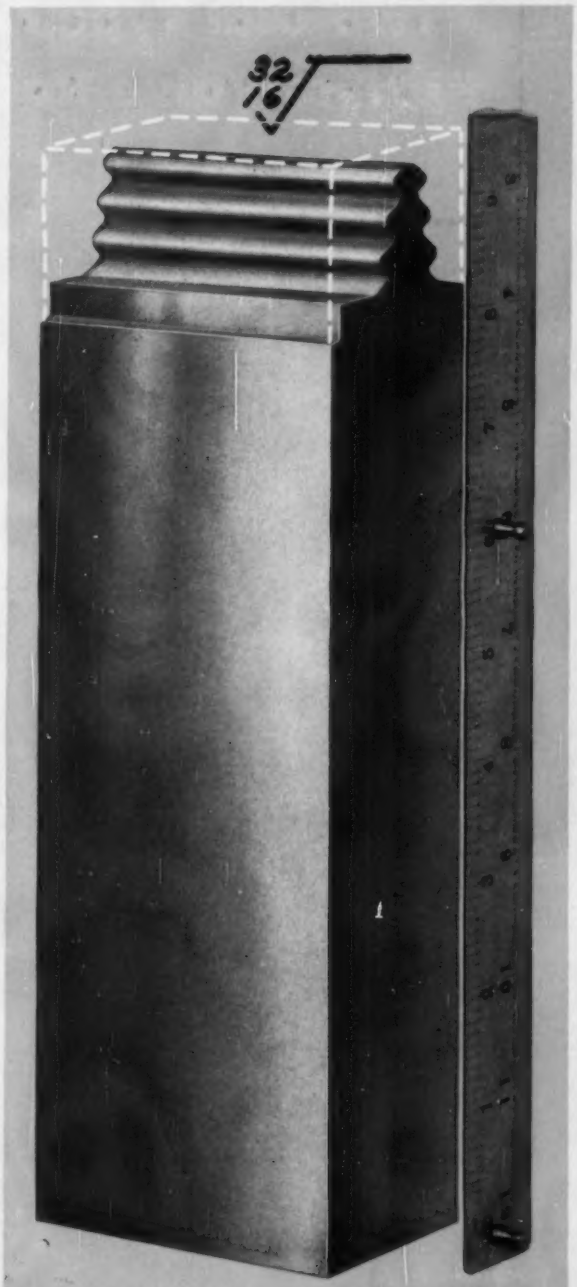
What a big blank — for a big blade! Stock removed is substantial on the three-inch-long intricate broached form. These blades, made from a tough, modified high-temperature alloy, are for the rotor of a steam turbine having a shaft horsepower of 42,500. *In one pass,* the form is Lapointe-Broached to a micro finish considerably better than the specifications require!

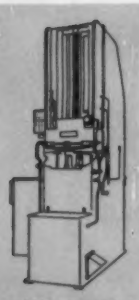
Built with 180-inch stroke and using only one fixture with three sets of interchangeable jaws, the 50 hp SRHE Lapointe Broaching Machine can broach the buckets for the entire set of blades *in all the sizes required* for this steam turbine. That means a total of 25 stages (14 low pressure and 11 high pressure)!

Have you considered converting to Lapointe-Broaching on some of your metal-removing operations? A Lapointe Field Engineer will be glad to help you.

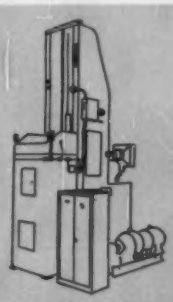
THE LAPOINTE MACHINE TOOL CO.
HUDSON, MASSACHUSETTS • U.S.A. In England: Watford, Hertfordshire

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES





VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC

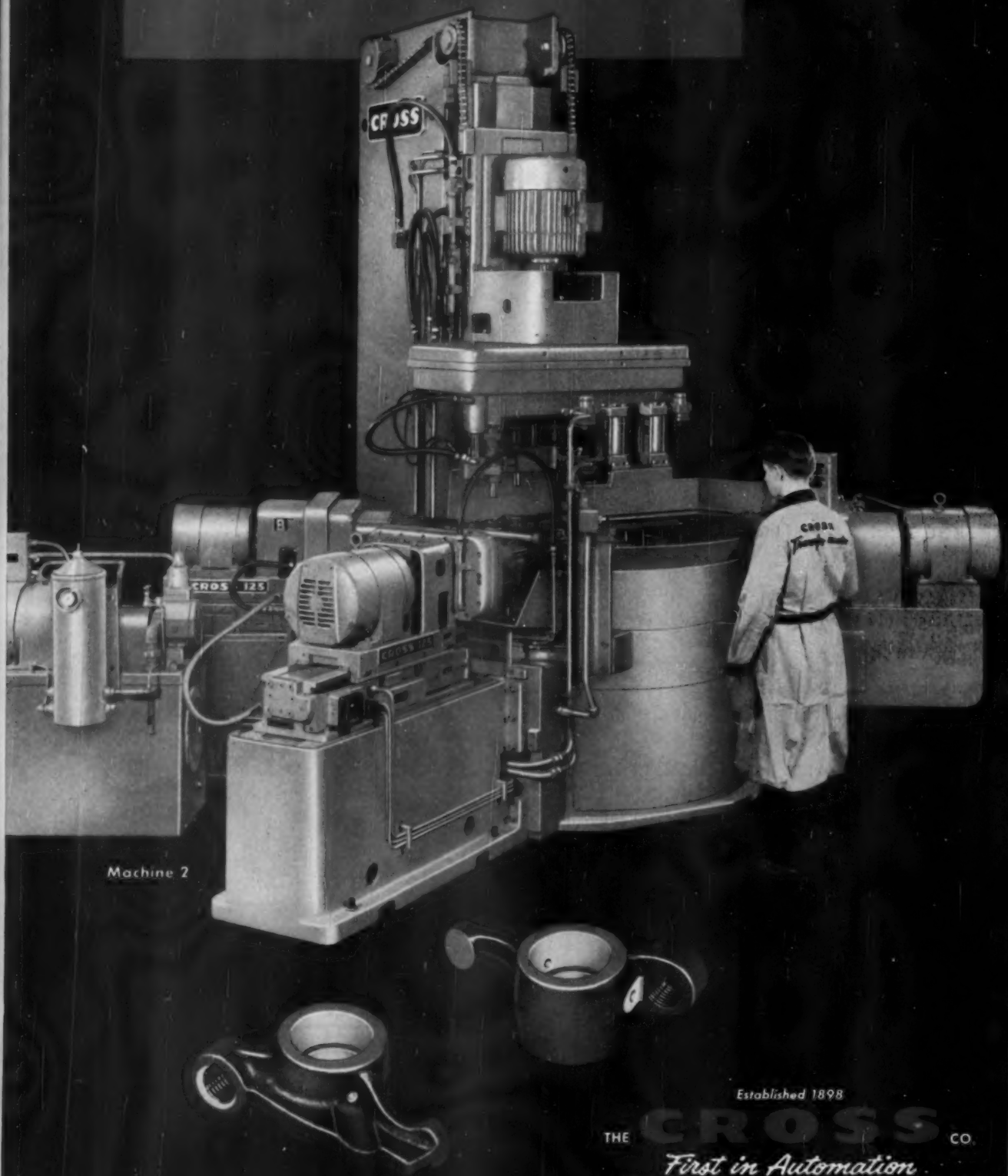
DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

known to be the best in

BROACHING

Two Dial Type Machines Process Valve Rocker Arms



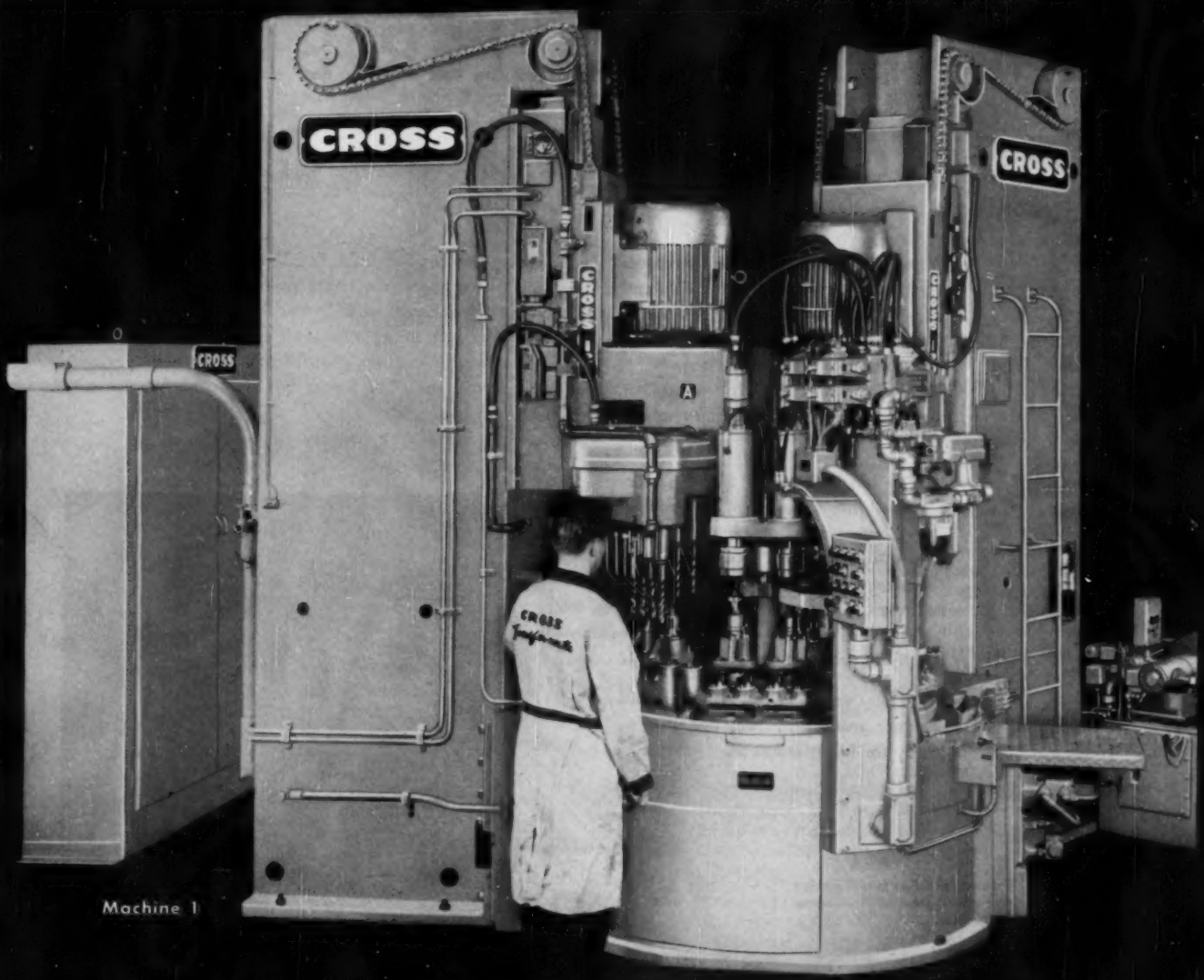
Machine 2

Established 1898

THE CROSS CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN



Machine 1

★ 800 pieces per hour at 100% efficiency.

★ Four parts machined in each station.

★ Machine 1 drills and reams rocker shaft hole; forms oil groove; drills one oil hole. Machine 2 drills, chamfers and taps adjusting screw hole; drills, counterdrills and spotfaces second oil hole.

★ Push button controlled power wrenches operate fixture clamps.

★ Cross "building block" construction provides flexibility for part design changes.

★ Complete interchangeability of all standard and special parts for easy maintenance.

★ Other features: Construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for drilling and reaming; individual lead screw feed for tapping; automatic lubrication; pre-set tooling throughout.

drive gears in BOLENS TRACTORS

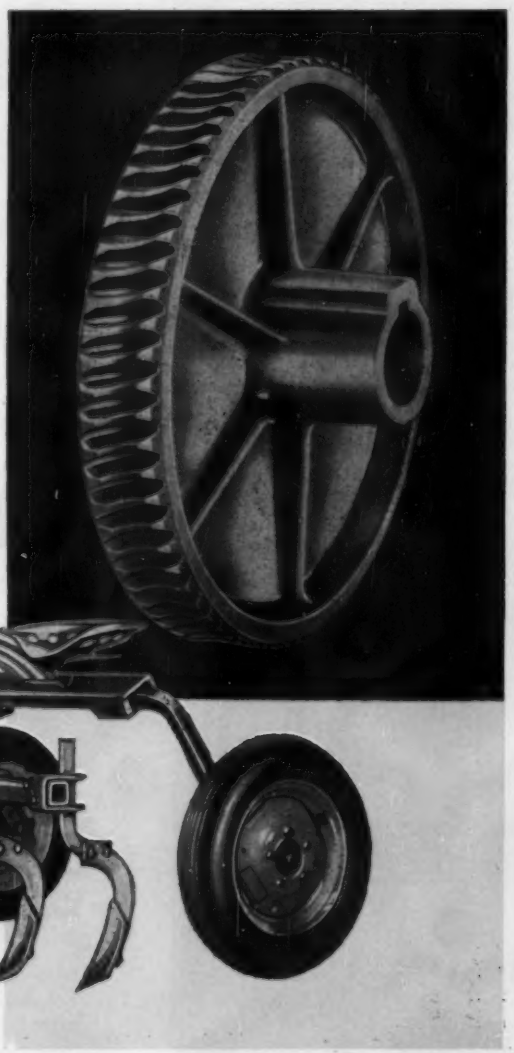
toughness of MUELLER BRASS

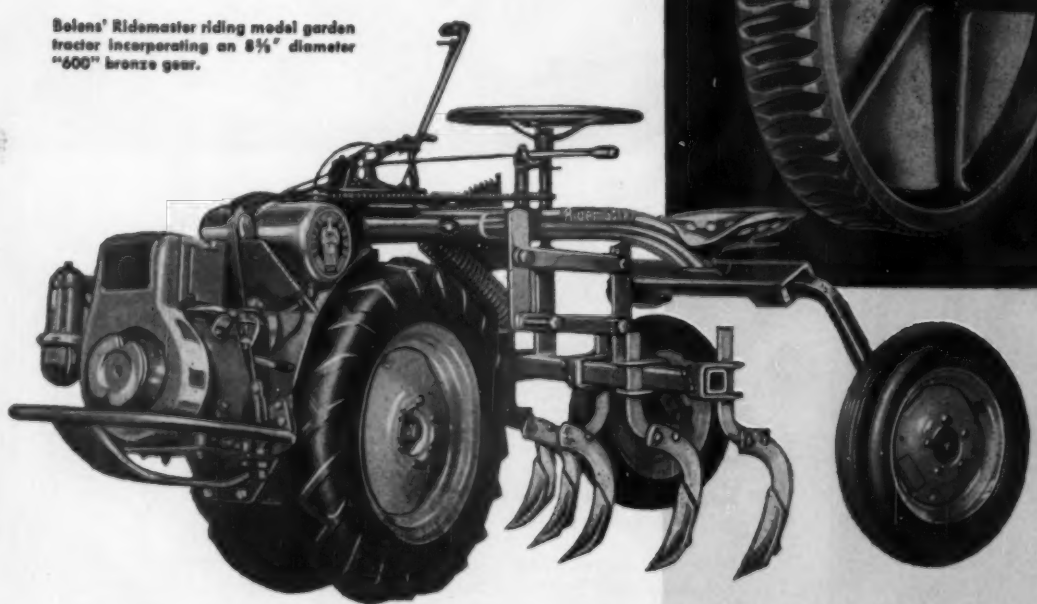
"600" series bronze alloys

Forged bronze gears made from tough, long-wearing Mueller Brass Co. "600" bearing alloy are proving their ability to withstand punishment in the popular outdoor power equipment manufactured by the Bolens Products Division of Food Machinery and Chemical Corporation, Port Washington, Wisconsin. The Junior and Super Mustang rotary tillers, all employ "600" main drive gears to dependably transmit engine power to drive assemblies. The going is rough for equipment of this type in cultivating or tilling heavy soil—but Bolens has a record for ruggedness and, on these and many other Bolens products as well, Mueller Brass Co. "600" gears help make possible that fine performance.

Mueller Brass Co. "600" bearing bronzes are available as forgings, or in rod form. They provide unusually high tensile strength, a dense structure, good resistance to corrosion, and excellent bearing properties. Because of their good machining qualities, the "600" series bronzes can be finished readily—usually at substantial savings in COST.

It will pay you to investigate these alloys for your products . . . why not write today for full information.





Bolens' Ridemaster riding model garden tractor incorporating an 8⅛" diameter "600" bronze gear.

and TILLERS prove

CO

Bolens' Super Mustang rotary tiller incorporating a 25-tooth "600" series bronze worm gear.

● WRITE TODAY FOR THE ENGINEERING MANUAL YOU NEED

Mueller Brass Co. Forgings Engineering Manual H-58565 ☐

Tuf Stuf Aluminum Bronze Alloys Engineering Manual H-58563 ☐

"600" Series Bearing Alloys Engineering Manual FM-3000 ☐

Copper Base Alloys in Rod Form Engineering Manual FM-3010 ☐

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METALS AND ALLOYS REVIEW

by FRANK M. LEVY

Vice-President and Director of Research

One of the most interesting things about our 600 series bearing alloys is the great variety of products in which they find application. In the advertisement to the left you can see how the Bolens people put 600 gears to work in their rotary tillers and garden tractors. Those gears are big, take a lot of abuse, and meet the job needs perfectly. We also make a lot of small parts, too, that have been specified because of the many unusual properties of this series of alloys.

One good example that comes to mind is a shaft bushing on a rotary selector switch that we make for an instrument manufacturer. This selector is used for switching sound-powered telephone circuits aboard Naval vessels. One of the most important considerations in the choice of 600 alloy for this bushing was its resistance to abrasive action on and against a rubber "O" ring. The acceptance test required a stainless steel shaft riding in the bushing to rotate "dry" for a minimum of 50,000 cycles consisting of 360° rotation clockwise followed by a 360° rotation counter-clockwise. The "O" ring must still form a watertight seal at the end of the test. Our 602 alloy was the only one of several materials tested that met the specs. That was pretty good evidence in itself of resistance to abrasion, but, in addition, this customer also found that the use of 602 eliminated the headaches they previously had with seizing and galling.

The pounding action caused by the indexing mechanism attached to the shaft used to give them no end of seizing troubles. The chief product engineer is extremely happy about the way our alloy is performing. Mention was also made of the fact that the corrosion resistance of 602 was mighty impressive. In this application, the alloy passed the 200-hour Navy salt spray test with flying colors.

So, big or small, it seems that there is no end of applications for 600 series alloys. We even have parts working in a machine that slices frankfurters as well as gears in fishing reels. So, it seems that 600 runs the gamut from "red hots to reels". Well, it looks like the end of the page is here again, so I'll close for now. However, if you have any problems or questions about non-ferrous alloys or you're having trouble getting desired performance from a part, why not drop me a line here in Port Huron, and possibly I can be of some service. Send a part print along if you like, and we'll be glad to make proper recommendations.

Thanks again for your time.

40

MUELLER BRASS CO.

PORT HURON 24, MICHIGAN

New ARMSTRONG

Armide CARBIDE INSERT TOOL HOLDERS

STYLE TR
(opposite Hand TL)
Holds Triangular 6-edge, Armide and other carbide "throw-away" inserts.

STYLE SR
(opposite Hand SL)
Holds square, 8-edge, Armide and other carbide "throw-away" inserts.

Buy **ARMSTRONG** TOOLS from your Industrial Distributor

Write for catalog

Embody...Convenience, Economy Simplicity and Strength based on these superior features:

- **IMPROVED CLAMPING METHOD—speeds indexing of inserts.**
- **REPLACEABLE SEAT of Hardened Tool Steel—protects shank and provides flat base to prevent damage to inserts as they are clamped in position.**
- **SHANK of Heat Treated Alloy Steel—gives extra strength and rigidity.**

A slight turn of a single screw permits rapid indexing of the ARMIDE insert—reducing down time to a minimum.

The use of ARMIDE "throw away" inserts provides the economy of multiedged inserts—triangular inserts have six, square inserts eight cutting edges. These are available in Utility or Precision finish and in three grades of ARMIDE: 350, 370 or 883.

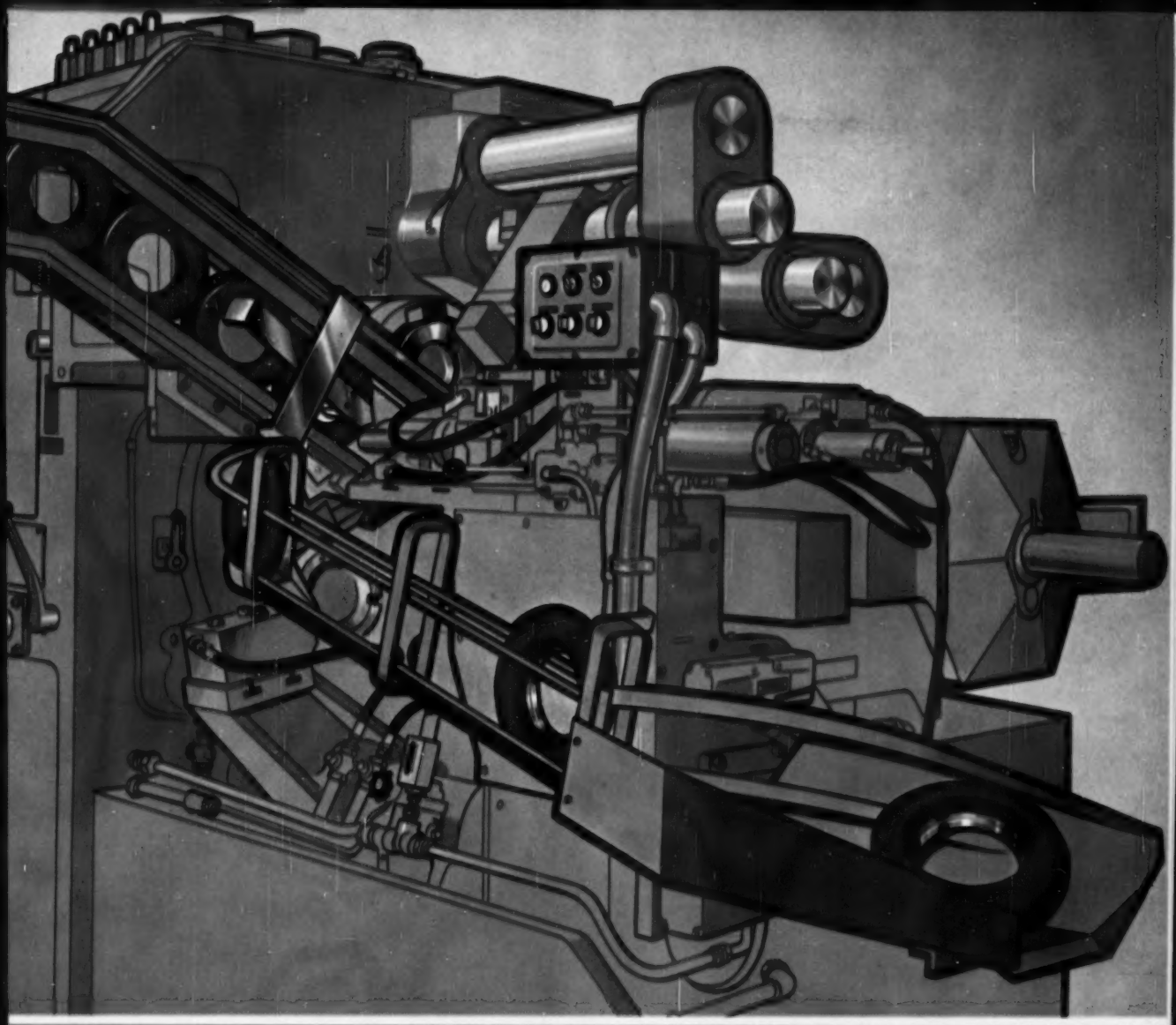
Protection to the shank is given by the replaceable tool steel seat which prevents wear and damage to the shank and provides a flat base for the insert, reducing the possibility of damage to the insert as it is clamped in place. A relief groove is ground into the seat providing clearance when a dulled insert with "built up" edges is turned over.

ARMSTRONG ARMIDE Carbide Insert Tool Holders are furnished in two styles and three sizes. Complete data on these tools is given in Bulletin CIT, mailed on request.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

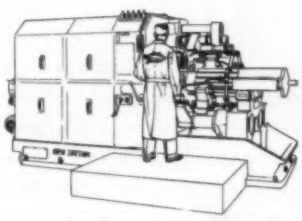
5215 W. ARMSTRONG AVENUE **CHICAGO 30, ILL.**



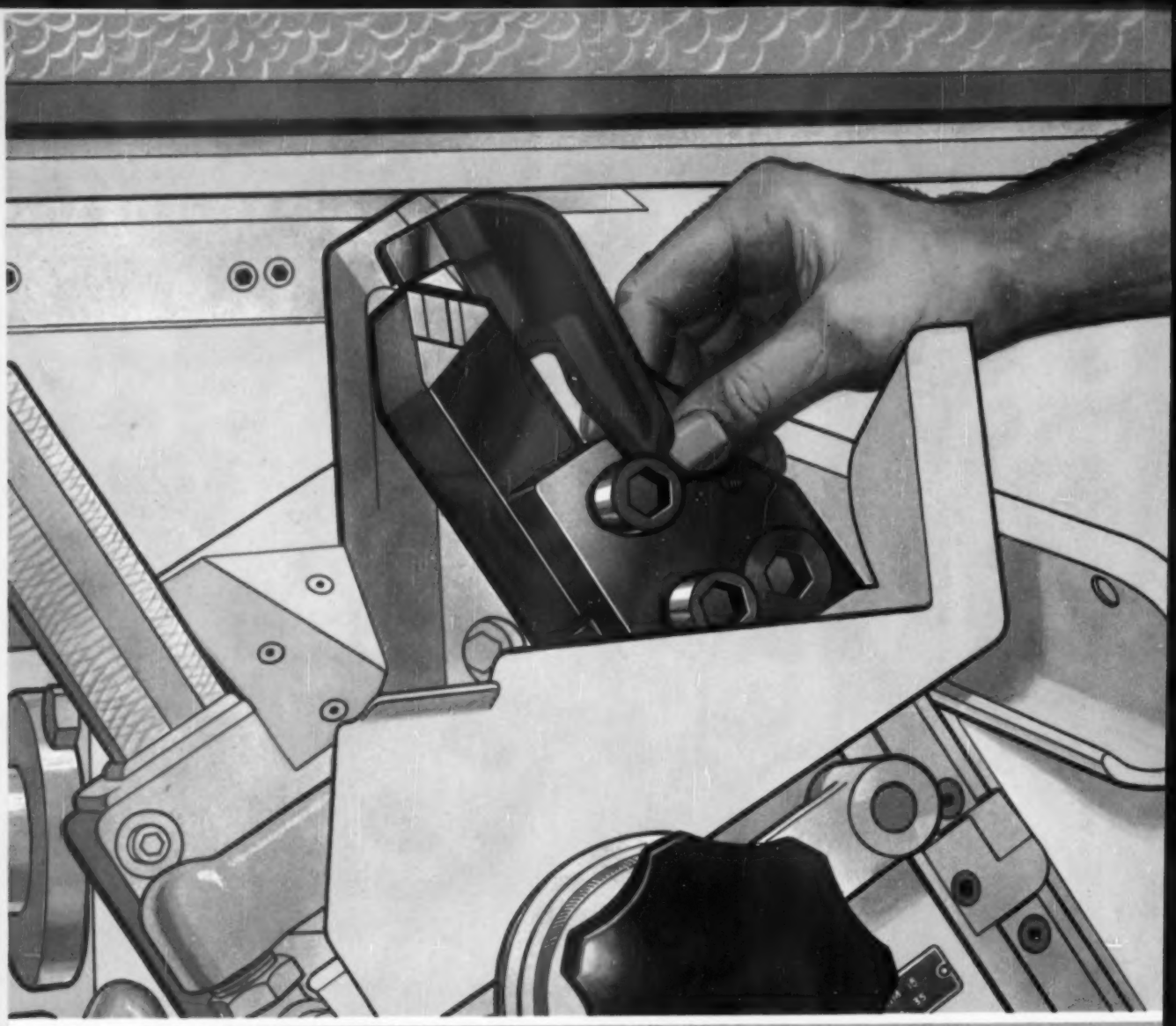
get more chucker work done

with automatic "handling"

New Britain chuckers are the time-tested leaders in their field. Their basic open-end design, an exclusive New Britain feature, makes them unusually well adapted to the automatic handling of pieces. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



Automatic Chucking Machine



1-minute tool change gets more contour work done

It's a fact — you can do more work in a day with a New Britain +GF+ copying lathe and a single-point tool, than with a conventional lathe using half a dozen. Just slip out the worn tool, slip in a new one, gauge it to a single dimension and you're ready to go again. The template repeats the dimensions. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

New Britain +GF+ Copying Lathe

A GENERAL ELECTRIC FIRST . . .

All-Position Welding On Mild Steel with Fillerarc * Equipment

NOW...GET FAST, ALL-POSITION WELDING USING CO_2 WITH EXCLUSIVE G-E FILLERARC GAS-SHIELDED PROCESS

At last, you can weld mild steel with low-cost CO_2 *without spatter and still get deep penetration.* General Electric's Fillerarc equipment makes this possible.

Compared with stick electrode welding, Fillerarc consumable-electrode, gas-shielded welding is twice as fast, eliminates spatter, and needs no extra-close fitup. Fillerarc equipment is available for both automatic and semi-automatic welding.

Here are some more important reasons why you can now weld in any position faster and better with Fillerarc equipment:

WELD WITH SMALL WIRE. Fillerarc wire drive *pulls* wire as small as .035 inches into the easy-to-use gun. This size wire tends to kink with push-type apparatus.

SPECIAL REACTOR permits five welding ranges for greater adaptability in all applications . . . plus better quality welds—without spatter.

FILLERARC GENERATOR with rising volt-amp characteristic holds a constant arc length, regardless of changes in current.

For more information about General Electric's semiautomatic Fillerarc welding process, contact your nearby G-E Welding Distributor or Welding Department Sales Office . . . listed in the yellow pages of your telephone book. Or write for bulletin GEC-989, General Electric Co., Schenectady 5, New York. 713-11

EXCLUSIVE FILLERARC WELDING technique is easy to learn. Even your new operators can begin making satisfactory welds in any position in less than ten minutes.

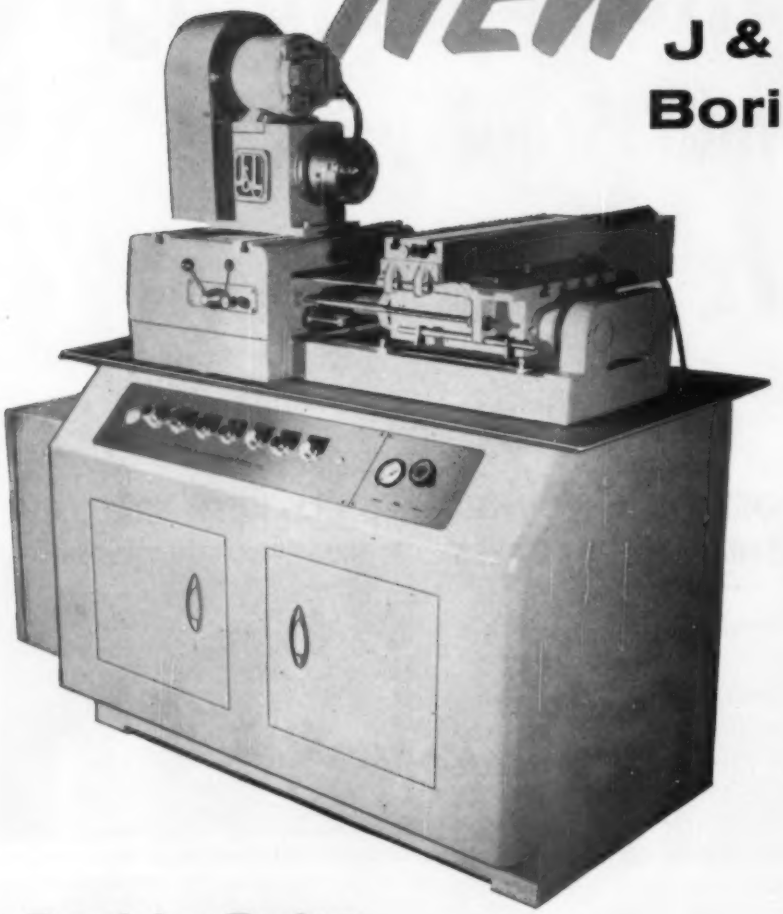
EFFECTIVE ALL-POSITION WELDING with Fillerarc process using CO_2 on mild steel was proved by demonstration at recent AWS Show. Ask for your demonstration today.

*Reg. trade-mark of General Electric Co.

Progress Is Our Most Important Product

GENERAL ELECTRIC

NEW J & L Precision Boring Machine



Base will accommodate *two spindles* for rough and finish boring, simultaneous facing and boring, or for boring two holes at once.

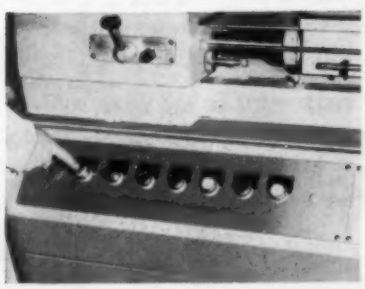
Work table feed is actuated with variable hydraulic check unit. Adjustable stops are easily set for length of rapid traverse and feed strokes.

Precision Boring– Turning – Facing at LOW COST

Jones & Lamson fills a long-felt need with this new J & L Precision Boring Machine. Now, it is possible to have truly precise turning, boring and facing operations at truly low cost.

This new machine is ideal for long *or* short runs . . . is extremely versatile . . . is easy to set up . . . and spindle runout is less than .000020″. Max. swing is 10″ dia. and max. bore is 3″ dia.

Write today for complete information.



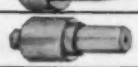
Push button cycling — manual or automatic.

J&L JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, Dept. 710, 502 Clinton Street, Springfield, Vt., U. S. A.

10 JOBS ANALYZED

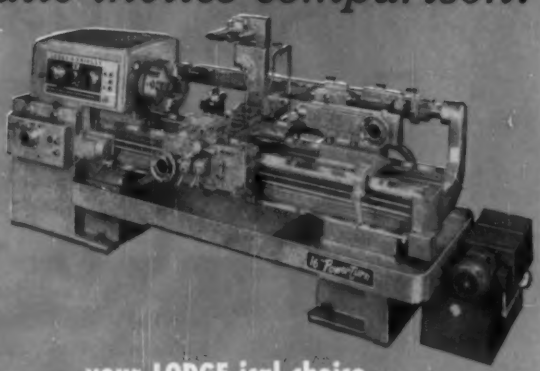
...important savings obtained on every one with new Lodge & Shipley Powerturn Copymatic lathe

Workpiece	Pieces in lot	Set-up hours	Machine hours	Total hours	Time/part minutes	TIME SAVED	Machine used
	48	2.1	6.2	8.3	10.3		automatic lathe
	60	0.9	3.6	4.5	4.5	56%	Powerturn Copymatic
	18	1.0	1.9	2.9	9.6		automatic lathe
	20	0.6	1.1	1.7	5.1	47%	Powerturn Copymatic
	30	2.7	9.1	11.8	23.6		automatic lathe
	40	1.7	6.8	8.5	12.7	47%	Powerturn Copymatic
	40	1.9	9.6	11.5	17.2		automatic lathe
	60	2.3	12.4	14.7	14.7	14%	Powerturn Copymatic
	20	0.4	0.9	1.3	3.9		automatic lathe
	20	0.3	0.3	0.6	1.8	53%	Powerturn Copymatic
	40	2.9	6.8	9.7	14.5		automatic lathe
	60	0.7	5.3	6.0	6.0	59%	Powerturn Copymatic
	20	2.5	3.4	5.9	17.7		automatic lathe
	29	0.5	3.1	3.6	7.4	59%	Powerturn Copymatic
	40	2.8	6.7	9.5	14.2		automatic lathe
	60	1.3	6.5	7.8	7.6	46%	Powerturn Copymatic
	40	1.5	6.6	8.1	12.1		automatic lathe
	30	1.3	3.2	3.5	7.0	42%	Powerturn Copymatic
	50	2.1	6.6	8.7	10.4		automatic lathe
	50	1.6	4.6	6.2	7.4	29%	Powerturn Copymatic

...the Powerturn Copymatic invites comparison!

A well-known machine tool manufacturer kept records on Powerturn Copymatic production compared to previously used automatic lathes . . . On the ten jobs recorded, savings in time alone range up to 59%! Average time savings were better than 45%! Note that set-up time (lower in every case) was included.

Virtually every Lodge & Shipley Copymatic installation has resulted in significant savings. Your Lodge & Shipley distributor will gladly help you investigate Powerturn Copymatic possibilities in your plant or write direct for additional case history data. **The Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.**



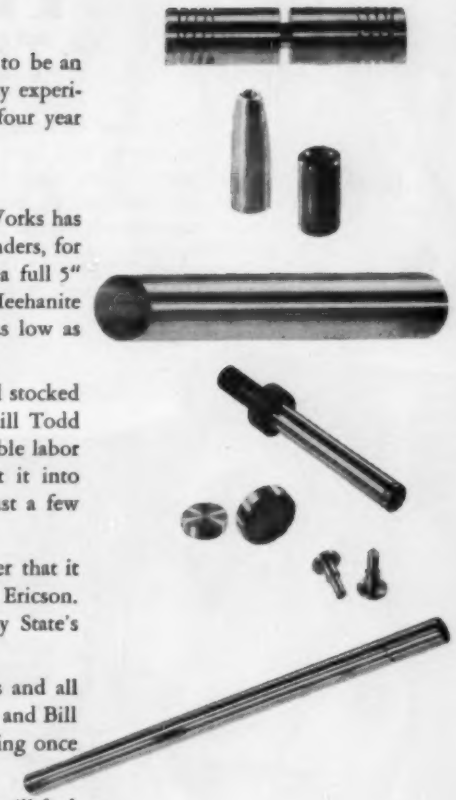
your LODGE-ical choice...

Lodge & Shipley

They made 1 wheel

Working closely with foreman Bill Todd (right) of Whitin Machine Works, Whitinsville, Mass., and with Bay State's sales engineering department, distributor Vic Ericson, of Johnson deVou, Worcester, Mass., has helped cut Whitin's grinding costs thousands of dollars a year.

do the work of 12



This is the story of two stubborn men and what seemed to be an impractical idea. The idea still seems pretty amazing to many experienced grinding men . . . but time and cost sheets over a four year period *prove* that it works.

Here's the story.

The central grinding department at Whitin Machine Works has all the problems of job-shop operation. Their centerless grinders, for example, are used to finish parts that range from 1/8" to a full 5" diameter and come in bronze, brass, aluminum, cast iron, Meehanite and all types of soft and hardened steel. Runs are short; as low as three or four pieces and rarely over a couple of hundred.

To handle this tremendous variety of jobs, the shop had stocked a dozen different types of grinding wheels and foreman Bill Todd wanted to simplify. He wanted to cut the amount of valuable labor and machine time that went into wheel changes and put it into production. And, what he really hoped to get was not just a few multi-purpose wheels but *one all-purpose* wheel.

Successful in convincing Whitin's tool control engineer that it was worth the try, he called in Bay State distributor Vic Ericson. Ericson accepted the challenge and went to work with Bay State's sales engineering department. The effort paid off.

The result was a single wheel that handles all the sizes and all the metals. On regular work, finishes average around #16RMS and Bill Todd's skilled operators can get as fine as #2; a single dressing once an hour maintains normal high production rates.

Whatever your company's abrasive problems may be, you'll find Bay State representatives ready to help and competent to work out practical solutions.

BAY STATE ABRASIVES

BAY STATE ® WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
Branch Offices and Warehouses: Bristol, Conn., Chicago, Cleveland, Detroit, Pittsburgh.
Distributors: All principal cities. Bay State Abrasive Products Co. (Canada) Ltd., Brantford, Ontario.

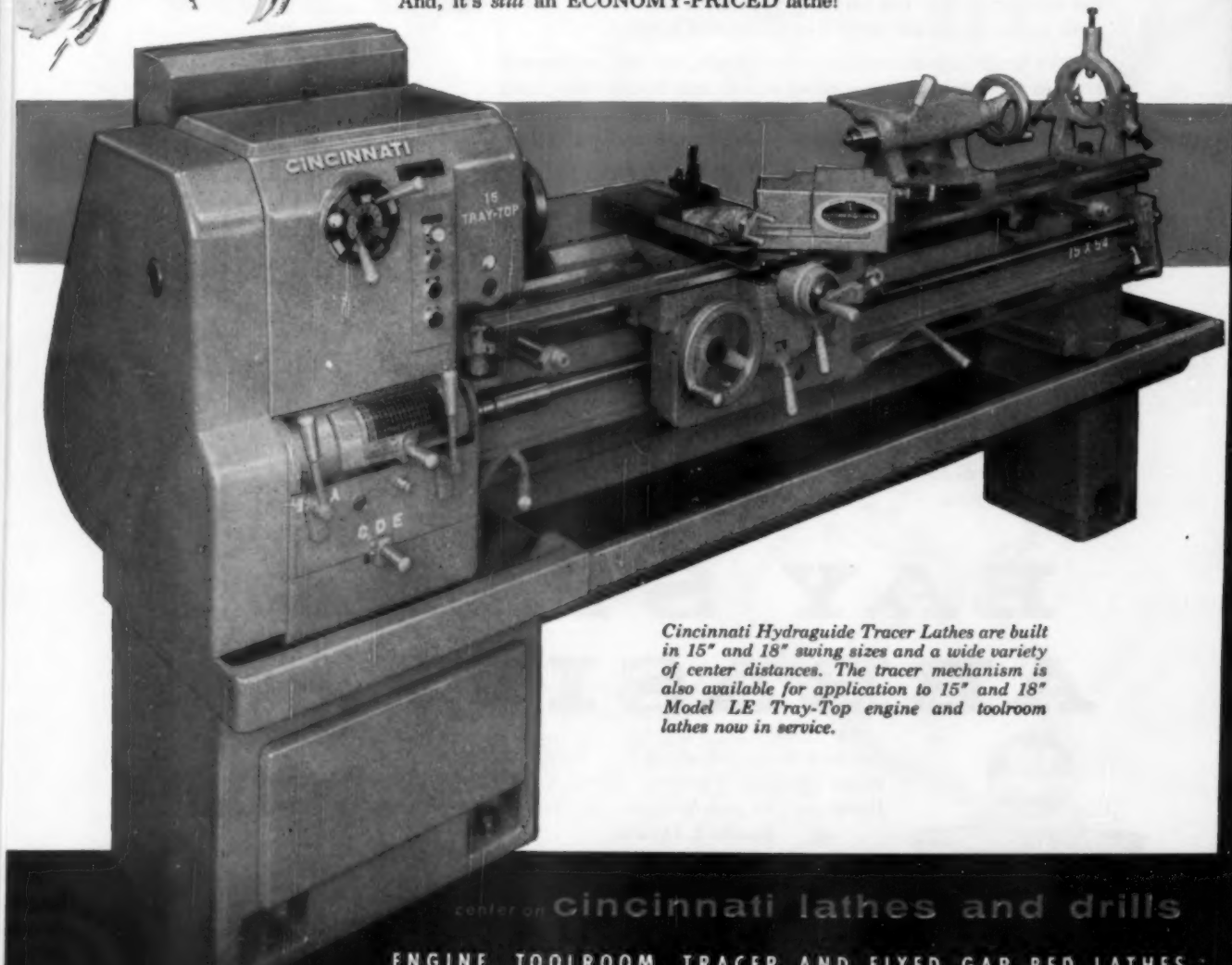
Switch to lowest-cost parts duplication with

CINCINNATI HYDRAGUIDE TRACER LATHES

The most valuable switchbutton in any shop is on these new Cincinnati Hydraguides®. You have only to push this button to provide lowest-cost tracer machining . . . yet, there is no interference with standard lathe operation. Everything is on the carriage, but nothing is in the way. Convenient, too! Everything for the operator is on the front side of the lathe.

ALL the proven Tray-Top features are included, of course . . . PLUS an increase to 5 horsepower for even greater performance.

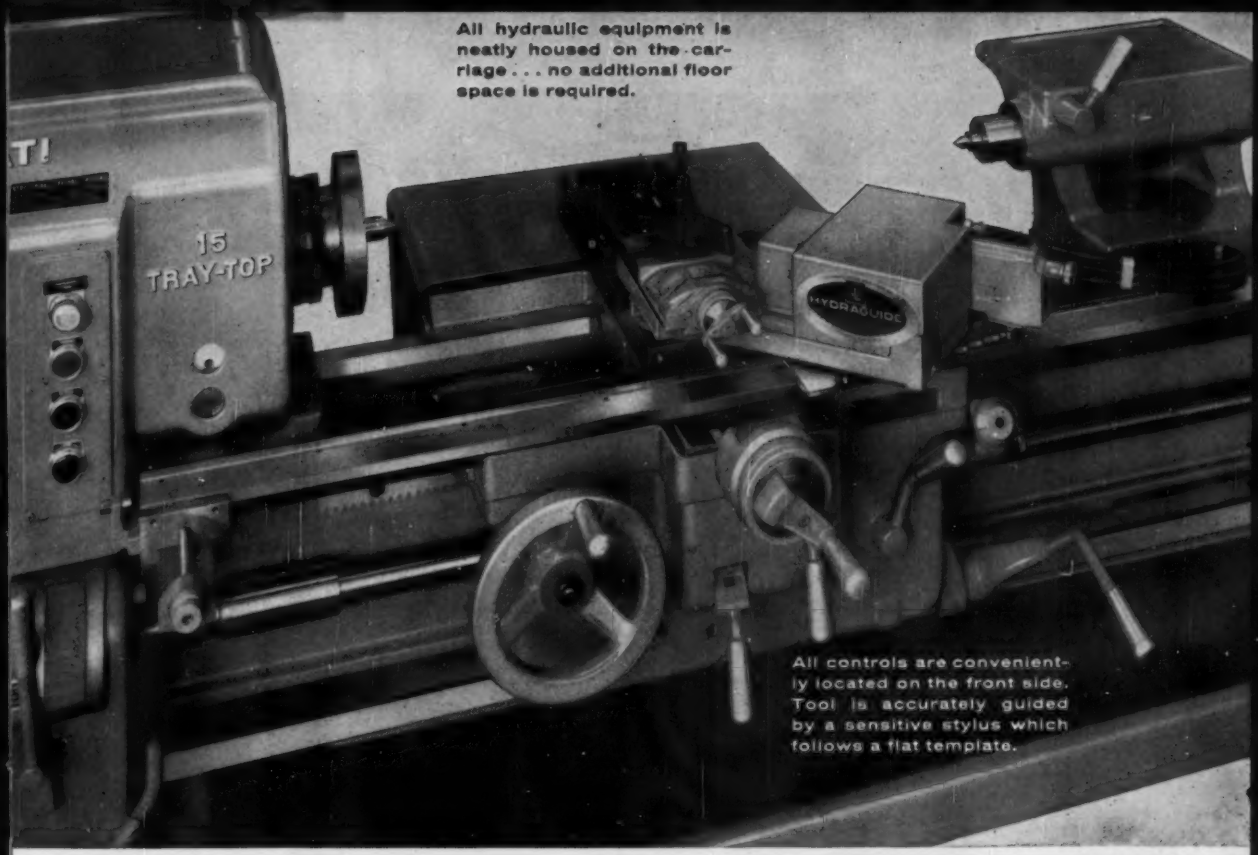
And, it's *still* an ECONOMY-PRICED lathe!



Cincinnati Hydraguide Tracer Lathes are built in 15" and 18" swing sizes and a wide variety of center distances. The tracer mechanism is also available for application to 15" and 18" Model LE Tray-Top engine and toolroom lathes now in service.

center on cincinnati lathes and drills

ENGINE, TOOLROOM, TRACER AND FIXED GAP BED LATHES


All hydraulic equipment is neatly housed on the carriage . . . no additional floor space is required.
15
TRAY-TOP
HYDRAGUIDE
All controls are conveniently located on the front side. Tool is accurately guided by a sensitive stylus which follows a flat template.

take advantage of newest tracer lathe economies NOW!

You get them all in the new CINCINNATI HYDRAGUIDE . . .

Unsurpassed VERSATILITY

Hydraguide performs exacting operations of turning, boring, shoulders, radii and many facing cuts . . . automatically controlled by flat, easily-made templates. Or, can be instantly used for standard lathe operations.

Unequalled COMPACTNESS

The complete Hydraguide is installed on the carriage. This provides more sensitive control because of shortest hydraulic linkage . . . requires no additional floor space.

Unexcelled CONVENIENCE

Hydraguide puts all controls, template, stylus, and tools on the operating side of the lathe. This simplicity of design provides maximum convenience and safety for the operator.

Untold PROFIT POSSIBILITIES

Hydraguide provides all the extra-value features of Tray-Top lathes . . . PLUS automatic duplication, less operator attention, lowest tooling cost, minimum tool setting, closer tolerances, less scrap—*lowered cost per piece.*

Ask your nearby C L & T Dealer for the Hydraguide story. Write today for full data and specifications—Catalog H-150.

It has ALL the Proven Tray-Top Features—

12 spindle speeds, instantly selected with direct-reading, color match dial.

Spindle speed range 37 to 1470 RPM.

All-geared spindle drive transmission.

Totally enclosed quick change gear box. 48 thread-feed changes.

Flame-hardened and ground bedways insure years of accurate service.

Hardened steel gears in all transmissions assure long-life operation.

Fully enclosed electrical controls increase operating ease and safety.

Many other features usually found only on larger, more expensive lathes.

CINCINNATI LATHE AND TOOL CO.

3207 Disney Street, Cincinnati 9, Ohio

AND A COMPLETE LINE OF DRILLING MACHINES

NEW ERICKSON EXPANDING-COLLETS

The new Erickson Expanding-Collet is the only known commercial expanding arbor that can grip in a hole as small as ⅛ inch. That's because it's a one-piece arbor actuated in the same manner as a reversed collet . . . a collet which grips the workpiece on the *inside surface*. Because of its one-piece design without drawpin, it gives maximum wall thickness and full gripping power equal to that of a collet.

That means you can convert your machine to internal chucking by merely inserting the new Erickson Expanding-Collet. And since it is machined in place on the machine, it gives greatest possible accuracy . . . can be re-machined for new jobs . . . solves the rush-order problem.

Order a stock of new Erickson Expanding-Collets. They'll save your time, your temper and your money.

AA-3961

Write for your free copy of "Erickson Expanding-Collet" today. And also request "Catalog K"; you'll find cost-slashing applications for all Erickson holding tools.

APPLICATIONS

LATHES • TURRET LATHES • SCREW MACHINES
SPEED LATHES • AUTOMATIC CHUCKING MACHINES
BURRING MACHINES • MILLING MACHINES • DRILL PRESSES
CUTTER AND CYLINDRICAL GRINDERS • GEAR CUTTERS
INDEXING HEADS • COLLET CHUCKS • ETC.

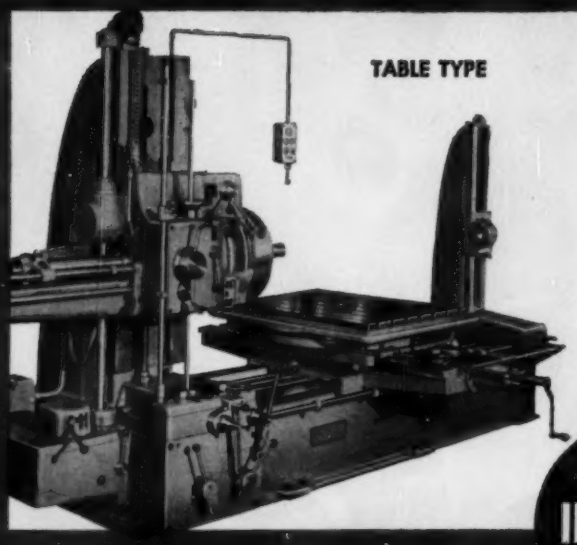
ERICKSON TOOL COMPANY

2309-7 Hamilton Avenue • Cleveland 14, Ohio

COLLET CHUCKS • FLOATING HOLDERS • TAP CHUCKS • TAP HOLDERS • AIR-OPERATED CHUCKS
EXPANDING MANDRELS • EXPANDING-COLLETS • SPECIAL HOLDING FIXTURES

OUTSTANDING HIGH PRECISION
HORIZONTAL BORING,
DRILLING AND
MILLING MACHINES

TABLE TYPE



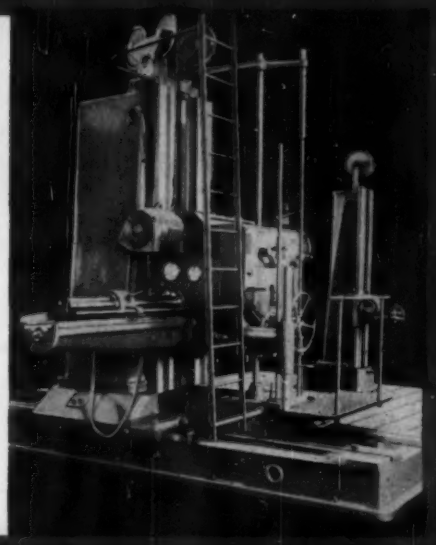
BFT - 80
3⅛" spindle diameter
Base price $18,880.

BFT - 100
4" spindle diameter
Base price $32,975.

BFT - 125
5" spindle diameter
Base price $43,880.

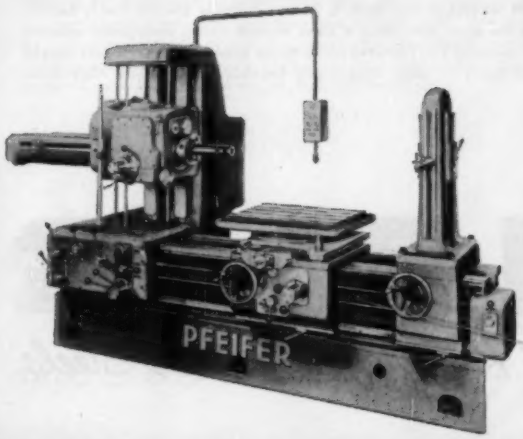
IMPERIAL

Power-saving drive ensuring full utilization of carbide-tipped tools. Very wide range of speeds and feeds to take care of all imaginable machining problems for smallest and largest working diameters. High-quality design of the bearing system for the inner and outer hollow spindle driven independently. All operating elements are neatly arranged, avoiding complicated switch-gear susceptible to trouble. Small manufacturing tolerances due to precision-scraped or ground guide-ways and highest accuracy of setting either by dial gauges or optical instruments.



FLOOR TYPE
BFT - 160
6¾" spindle diameter
Base price 147,880.

MODEL FO
Base price from $9,5[illegible]



SPINDLE HEAD—The spindle head is of rugged and compact construction.

TURNING—High degree of flexibility. Employed as a standard lathe and a facing lathe.

OPTICAL POSITIONING—The optical measuring equipment used in this machine furnishes readings easily and is easily understandable for the operator.

ACCURATE POSITIONING BY DIAL AND GAUGE BLOCKS.

TABLE—Rotating square, rotary table can be turned for one complete revolution.

MULTIPLE LENGTH AND CROSS FEED STOPS.

PFEIFER

AARON
MACHINERY CO., INC.
DEPT. AC 45 CROSBY ST., NEW YORK 12, N. Y. WA 5-8300

[illegible] Buffalo, N. Y. Atlanta, N. Y. Los Angeles [illegible]

HEAVY-DUTY SERVICE of this Black & Decker portable electric saw is demonstrated by the ease with which it slices through heavy corrugated asbestos board. An abrasive disc replaces conventional blade. Cutaway shows rugged drive gears made of tough, long-lasting Republic Cold Finished Alloy Steel.

REPUBLIC

REPUBLIC STEEL

World's Widest Range of Standard Steels

REPUBLIC COLD FINISHED ALLOY STEEL WITHSTANDS SHOCK AND HEAVY LOADING

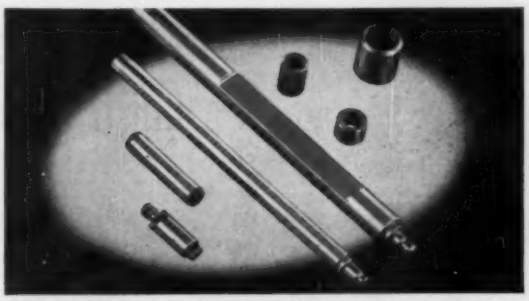
in Black & Decker Portable Electric Tools

Heavy-duty performance and reliability have played a major part in establishing a first-class product reputation for The Black & Decker Manufacturing Company, Towson, Maryland. Maintenance of this reputation requires constant vigilance in quality control of both methods and materials. Consistently, Republic Cold Finished Alloy Steels have met every requirement for vital gear train components. The strength and toughness of these steels gives Black & Decker gears the ability to shrug off repeated shock and heavy loading—and come back for more.

Black & Decker's experience with Republic Cold Finished Alloy Steels is typical of thousands of users throughout industry. Republic produces every standard analysis plus many specials to give you the correct combination of chemical and mechanical properties to suit your application exactly. Or Republic Metallurgists will be glad to work with you in developing an analysis tailored to meet the most particular needs. In every case, the cold drawing process provides an exceptionally bright, smooth finish, accurate size, cross section and straightness, plus ultimate strength, yield point, hardness and machinability superior to the same analysis in hot rolled form.

Why not check on the many advantages Republic Cold Finished Alloy Steel can offer your products? Simply call your local Republic office or mail the coupon.

REPUBLIC COLD FINISHED CARBON STEEL helps the manufacturer of this high-accuracy target pistol score production and product-quality bull's-eyes. Used for the most important part of all—the barrel—the predictable characteristics and uniformly excellent machinability of Republic Cold Finished Steel Bars keeps mass-produced perfection aims on target. Mail coupon for data.



REPUBLIC COLD FINISHED ENDURO STAINLESS STEEL has proved ideal for these carburetor components. Since ENDURO® is solid, it requires no applied surface which might be damaged or worn off. Corrosion protection extends clear through the part. Moreover, the excellent mechanical properties and machinability of ENDURO are improved still further by cold drawing. For details, send coupon.

STEEL

and Steel Products

REPUBLIC STEEL CORPORATION
DEPT. C-3102
3102 EAST 45th STREET • CLEVELAND 27, OHIO

Please send me more information on:
- ☐ Cold Finished Alloy Steel
- ☐ Cold Finished Carbon Steel
- ☐ Cold Finished ENDURO Stainless Steel

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

Universal collapsing tap parts of **MAX-EL** alloy steel finish machined after full heat treatment

Considerable machining is required in the manufacture of parts for these taps. That's why Crucible MAX-EL® 3½ free machining alloy steel was chosen by the Geometric Tool Company, Division of Greenfield Tap and Die Corporation. For with MAX-EL you can rough machine, *then* heat treat even intricate parts before final machining *with no danger of distortion of the steel.*

But the best way to check the advantages of MAX-EL is to try it in your own shop. Like many other users you'll appreciate its superior machinability, freedom from distortion, deep hardenability characteristics, uniformity and quality. And you'll like the longer tool life you get by using MAX-EL.

For complete data . . . and *quick delivery* of MAX-EL alloy steels, from local warehouse stocks, call *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

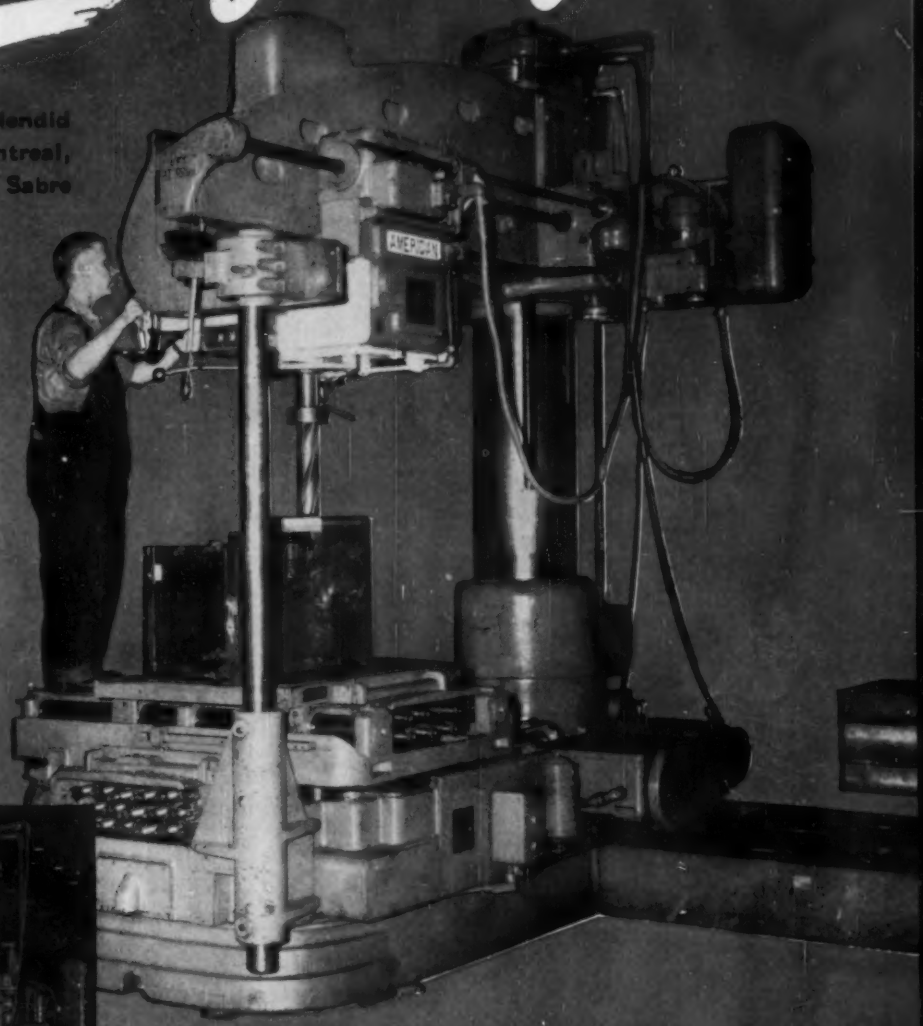
CRUCIBLE first name in special purpose steels

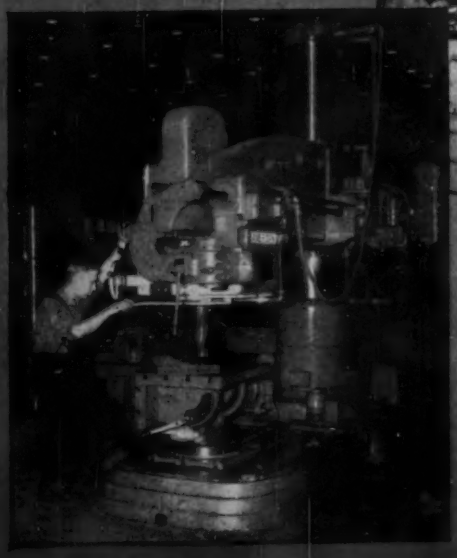
Crucible Steel Company of America

On TOP of his job!

This operator is doing a splendid job at Canadair Limited, Montreal, on the production of F-86E Sabre Jets for the RCAF and, as the illustration shows, he is right on top of his job, too.

He is proud of his fine new 6' 17" column "AMERICAN" Hole Wizard Radial. "It's powerful; it's sturdy; it's easy to operate, and I'm not worn out at the end of the day". What more could any operator ask? As a consequence he turns out a lot of fine work which makes his machine a paying investment for the company.





This *"American"* Hole Wizard Radial has a right angle base, on one wing of which is mounted a Bullard Man-Au-Trol Spacer—as shown by the illustration.

"AMERICAN" Hole Wizard Radials are playing a prominent part in the production of critical defense items for both the U. S. A. and Canada.

For a complete revelation of their virtues send for descriptive bulletin No. 327.

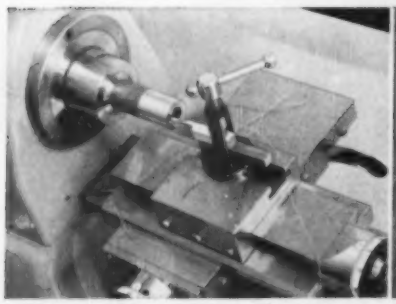
THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

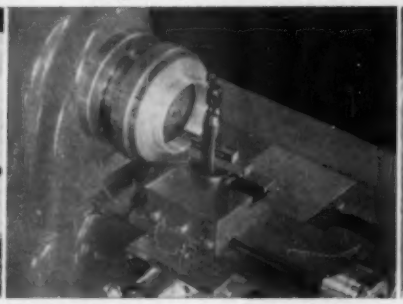
HARDINGE
ELMIRA, N.Y.

HIGH SPEED PRECISION LATHE

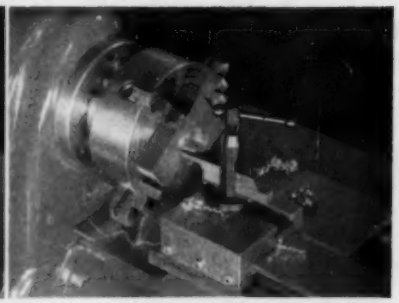
Correct Size - High Speed - Precision Results



Collet Work — The right machine for collet work of 1-1/16" or less diameter.



Step Chuck Work — For rapid and accurate holding of tubing, castings, moldings, stampings and machined parts. Capacity to 6".



Jaw Chuck Work—Integral mount, universal or independent, for extra accuracy. Capacity to 5".

SPECIFICATIONS:
1⅛" Collet Capacity
9" Swing
17" Center Distance
Infinitely Variable Speed
230—3500 r.p.m.

The above three important requirements for proper lathe work in tool rooms, production departments, or laboratories are completely fulfilled by the new Hardinge DV59 High Speed Precision Lathe.

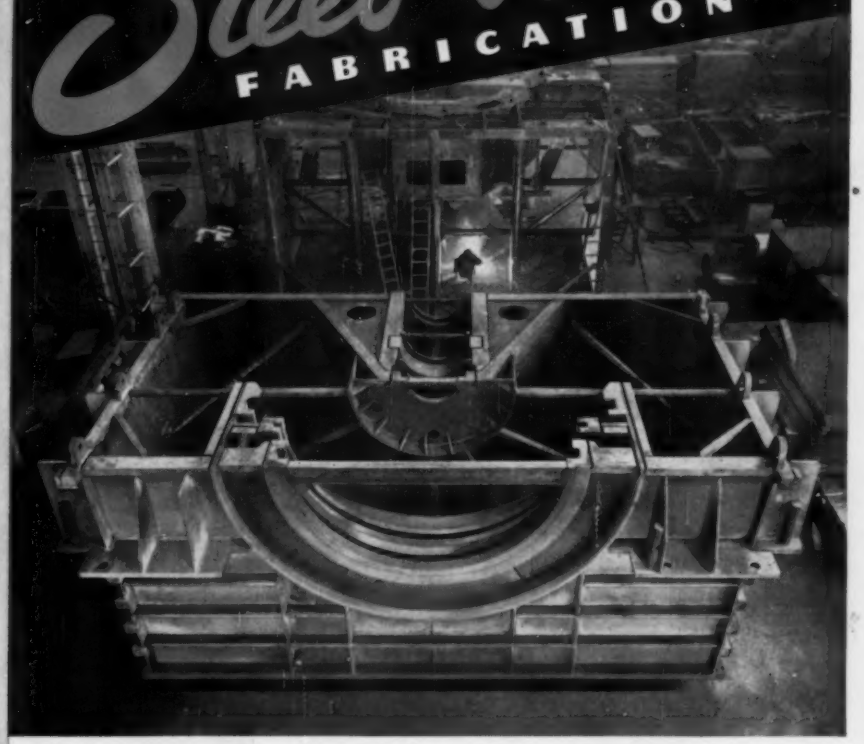
Correct size of the machine in relation to work saves loss from under-capacity production on larger lathes. High spindle speeds, up to 3500 r.p.m., permit full capacity cutting and excellent finish. Sustained accuracy and ease of operation assure precision results.

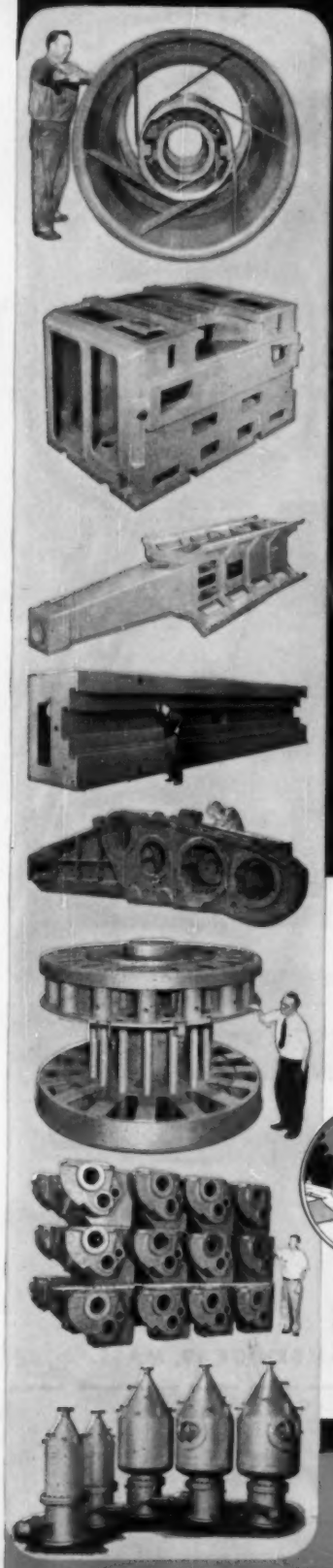
OFFICES IN PRINCIPAL CITIES.
Export Office: 269 Lafayette St., New York 12, N. Y.

Send for Free illustrated Bulletin DV 59

HARDINGE BROTHERS, INC., ELMIRA, N. Y.
"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Steel-Weld FABRICATION





Use WELDED STEEL for Greater Strength with Less Weight!

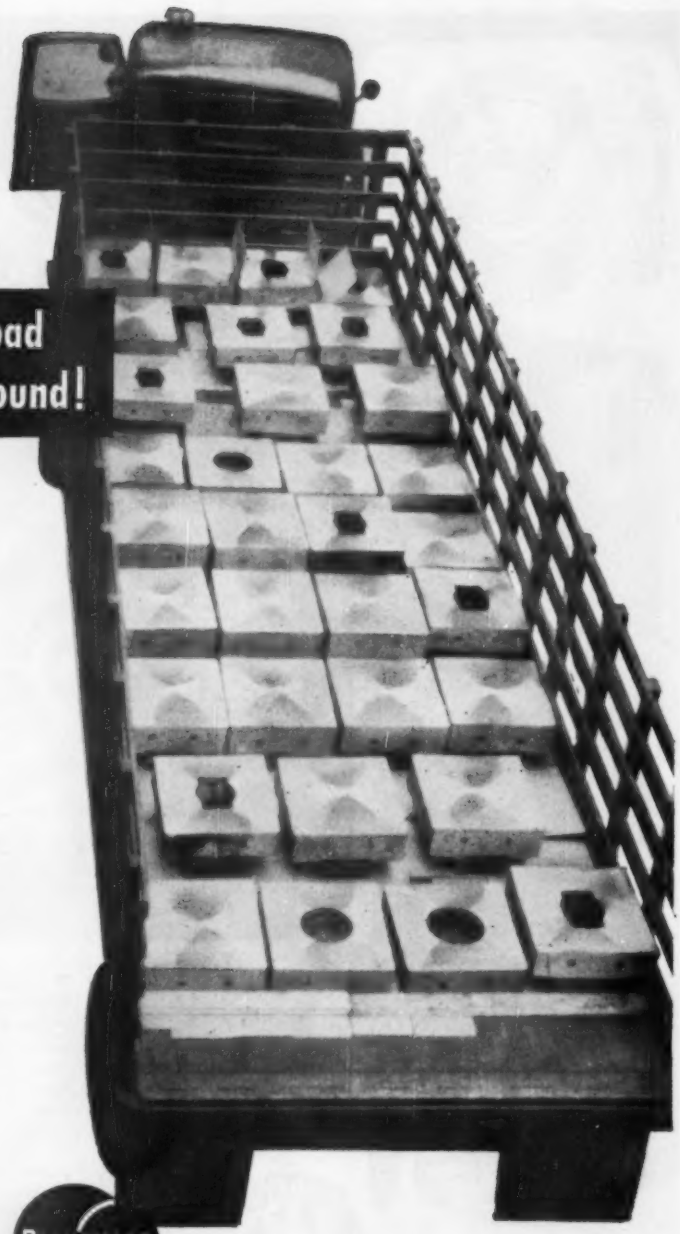
The weldment shown above is one half of the base for a 300,000 KW Steam Turbine...it weighs over 100 tons. This base, and the units shown at left, are typical of the thousands of Steel-Weld Fabricated parts and assemblies produced by Mahon each year for manufacturers of processing machinery, machine tools, and other types of heavy mechanical equipment. Are you taking full advantage of the economies offered by welded steel components in your products? In the design of almost any type of heavy machinery, or mechanical engineering project, there are parts and subassemblies that can be produced more economically and more satisfactorily in welded steel . . . because, in weldments you get greater strength with less weight, plus the additional advantages of greater rigidity and 100% predictability. When you consider weldments, you will want to discuss your requirements with Mahon engineers, because, in the Mahon organization you will find a unique source for weldments or welded steel in any form . . . a fully responsible source with complete facilities for design engineering, fabricating, machining and assembling . . . a source where design skill is backed-up by craftsmanship which assures you a finer appearing product embodying every advantage of Steel-Weld Fabrication. See Sweet's Product Design File for information, or have a Mahon sales engineer call at your convenience.

THE R. C. MAHON COMPANY • Detroit 34, Michigan

Sales-Engineering Offices in Detroit, New York and Chicago

Engineers and Fabricators of Steel in Any Form for Any Purpose

MAHON



Precision by the Truckload -- they're Blanchard ground!

This truck is loaded with 14 tons of steel. Its cargo is 33 soft steel plates, each measuring 27½" x 25½" x 11.125", and ground to ± .001" on a Blanchard Surface Grinder.

Dies up to 84" across corners, can be ground on a Blanchard at great savings. Grinding can be controlled without guesswork—leaving a flat, sharp die—as soon as the entire surface is cleaned up. Die resharpening on the Blanchard allows you to get maximum life from your valuable dies and end plates.

Ask for details on the 15 standard Blanchard models.

For best results in surface grinding . . .

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS.

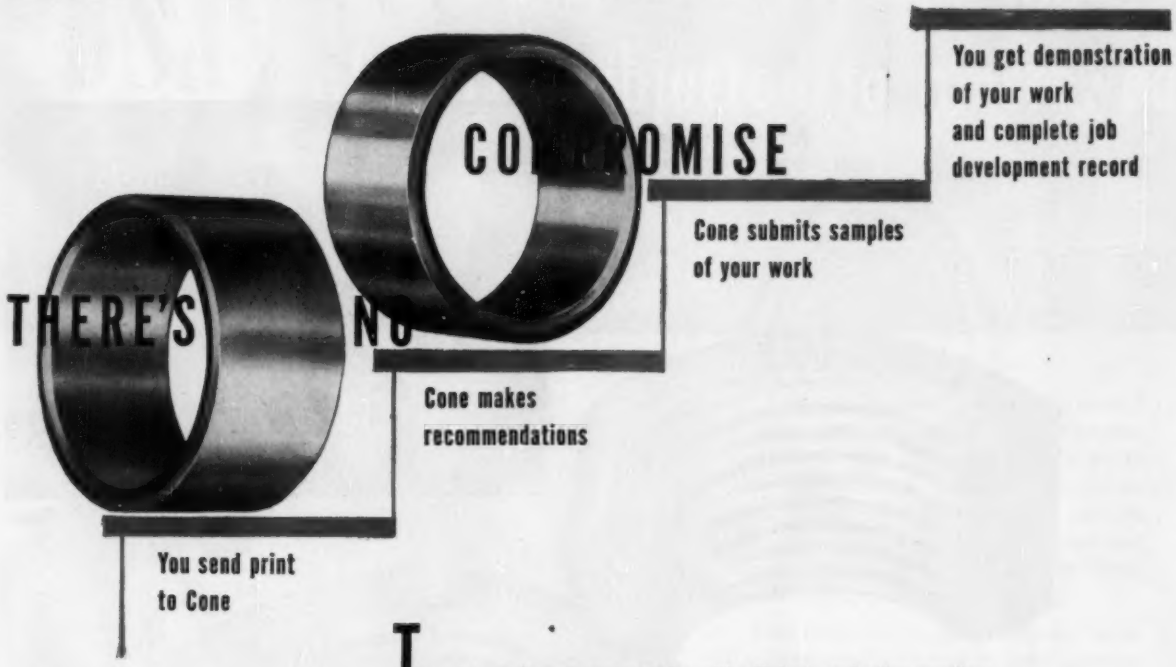
THE BLANCHARD MACHINE CO., 64 State St., Cambridge 39, Mass.

Gentlemen: Please send me a free copy of "The Art of Blanchard Surface Grinding" (3rd edition) and "Work Done on the Blanchard" (5th edition)

NAME_____ STREET_____

FIRM_____ CITY_____ ZONE____ STATE_____

No. 6 in a series


THERE'S NO COMPROMISE
You get demonstration of your work and complete job development record
Cone submits samples of your work
Cone makes recommendations
You send print to Cone

There is no adequate compromise with efficient production practices, if you are in business for a profit.

But you don't always know just how competitively efficient your equipment is. Case histories of what the other fellow is doing are sometimes garbled. At least the poor ones are not advertised. And conditions vary in all plants. Sometimes you have reason to be more concerned with what you don't want in new equipment than with what you do want. Cone believes too much is at stake for a machine to go into a line unequipped for the job, with either carbide or hss tools.

The Conomatic Carbide Development treats each job individually from standpoint of work, machine, tools, and operating personnel.

DATA FOR COMPARISON

Part	Bushing	Length	5/8"
Machine	1 5/8" Conomatic	Hole Dia.	1 1/4"
Tools	100% Carbide Tipped	RPM	825
Material	8620	Time	14.8 Secs.
Stock Size	1 5/8"		

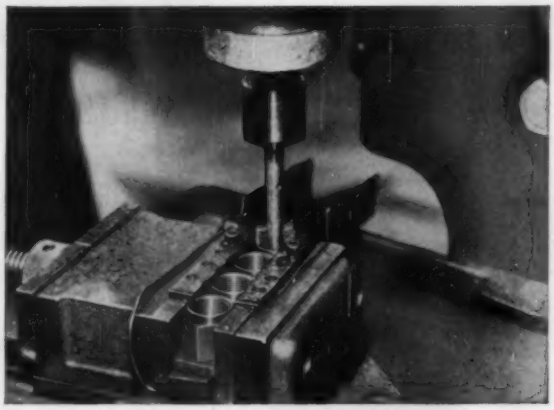
Conomatic

For particulars send for "Four Steps With Cone"

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

OSBORN BRUSHING METHODS *worthy of your confidence*

Removing chips and burrs from threads with Osborn Situfit® Brushes assures a good fit.



Before Brushing

After Brushing

Cleaning up... when the chips are down

In precision tapping, tiny abrasive chips and burrs deep down in the threads can be removed easily to assure close fit and prevent excessive wear on thread gages.

Osborn power brushing performs this operation quickly and efficiently with the simplest of equipment. Rejects, a profit-taker for any company, are cut to a minimum.

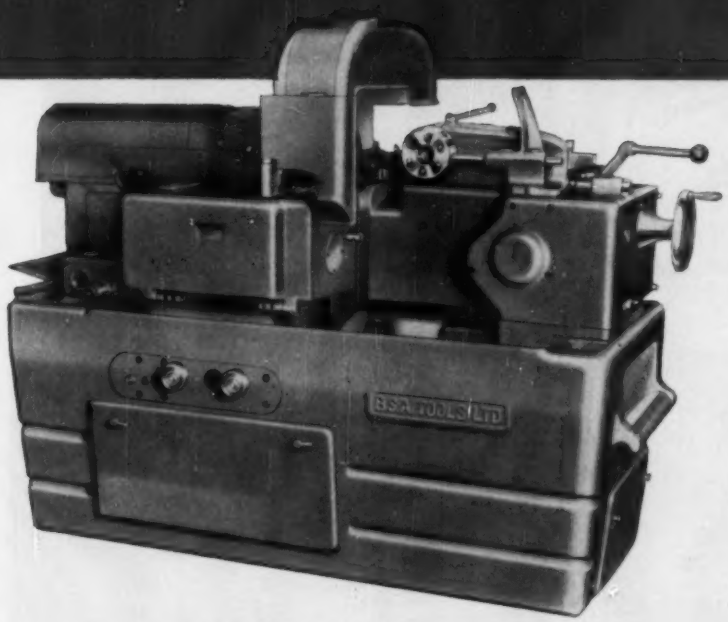
An **O**sborn **B**rushing **A**nalysis, made in your plant without obligation, may point out a number of ways Osborn power brushing can improve your metal finishing operations. For details, write *The Osborn Manufacturing Company, Department C-59, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

Osborn Brushes

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

BSA first to provide UNIT REPLACEMENT of parts subjected to most wear

to keep important production flowing with new machine performance



With speeds, machining accuracy, ease of tooling and operation and maintenance equal or superior to any machine in its classification, BSA Single Spindle Automatic Screw Machines offer a very definite plus value through "*unit construction and replacement*" of work spindles, side slides, turrets and gear boxes.

Unit construction, plus extremely rigid, one-piece machine frame makes it possible to bring BSA machines back to factory standards of perfection quickly. You place an important unit back in the line with a minimum of lost production.

Shipment of replacement parts are speeded to you from National Acme, in Cleveland. Here, also, full engineering and design services as well as demonstration and service facilities, in the National Acme tradition, are available to you.

May we explain how "*unit construction and replacement*" can ease your production problems?

Additional Production Advantages of BSA

FIVE STANDARD CAPACITIES: ½" ¾", 1", 1⅛", and 2".

WIDE RANGE OF SPINDLE SPEEDS—200 to 6000 on ½" machine, 69 to 1260 on 2" model.

Cams, change gears and tooling easily accessible FOR QUICK JOB-TO-JOB CHANGEOVER.

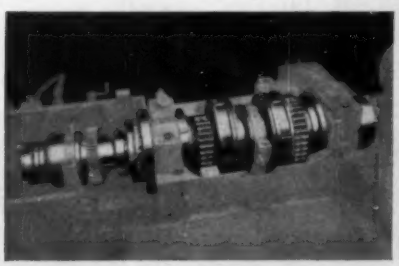
Unit construction provides quick access for EASY MAINTENANCE.

Special spindle mounting, DESIGNED TO REDUCE WEAR.

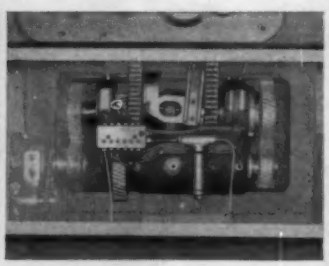
Positive chain drive from gear box to spindle PREVENTS SLIPPAGE.

All models use STANDARD AMERICAN TOOLING

UNIT CONSTRUCTION SPEEDS REMOVAL OR REPLACEMENT



Work Spindle



Gear Box

Side Slides and Turret

Distributed and Serviced in U.S.A. by...

National Acme

THE NATIONAL ACME COMPANY, 171 E. 131ST ST., CLEVELAND 8, OHIO • Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 27, Mich.

NOW – new design efficiency that delivers up to 80% faster production

BROWN & SHARPE AUTOMATICS for this FULL RANGE OF WORK SIZES

Now, right up the line, all Brown & Sharpe Automatic Screw Machines have the new design features that boost over-all efficiency 33⅓% higher . . . production rates up to 80% faster than in models replaced.

up to ½"

No. 00 takes stock to ½" dia.

Spindle speed range 7200 to 34 rpm
Turns any length to 1" . . . with optional equipment, to 1½"
Ratios, high to low speeds 2.3:1 to 16:1

up to ¾"

No. 2 – in THREE SIZES

Take stock to	¾" dia.	1¼" dia.	1½" dia.
Spindle speed range	5050 to 25 rpm	3500 to 17 rpm	2450 to 17 rpm

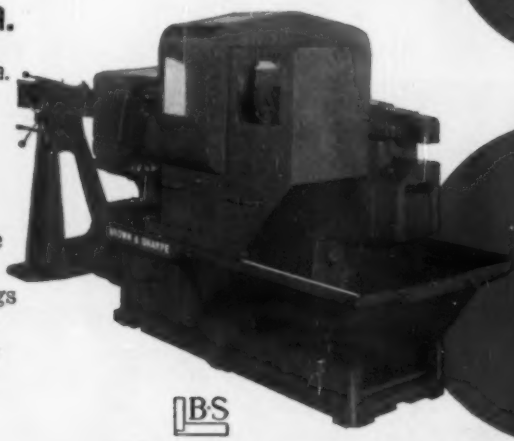
Turn any length to 2½" . . . with optional equipment, to 3½"
Ratios, high to low speed 2.2:1 to 15:1

up to 1¼"

up to 1½"

No. 4 takes stock to 2" dia.

With outside feed, takes stock up to 2⅜" dia.
Spindle speed range 1965 to 17 rpm
Turns any length to 5"
Ratios, high to low speeds 2.2:1 to 13:1



up to 2"

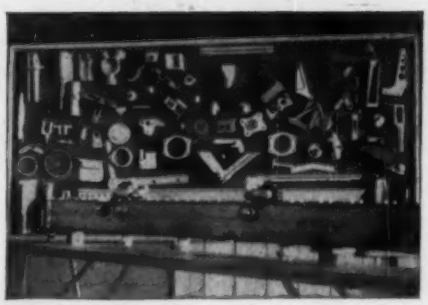
Get complete information. Compare for adaptability . . . precision . . . ease of set-up. Figure the big savings you could make, and you'll see why so many buyers say, "They pay for themselves, in record time."
Brown & Sharpe Mfg. Co.,
Providence, R. I.

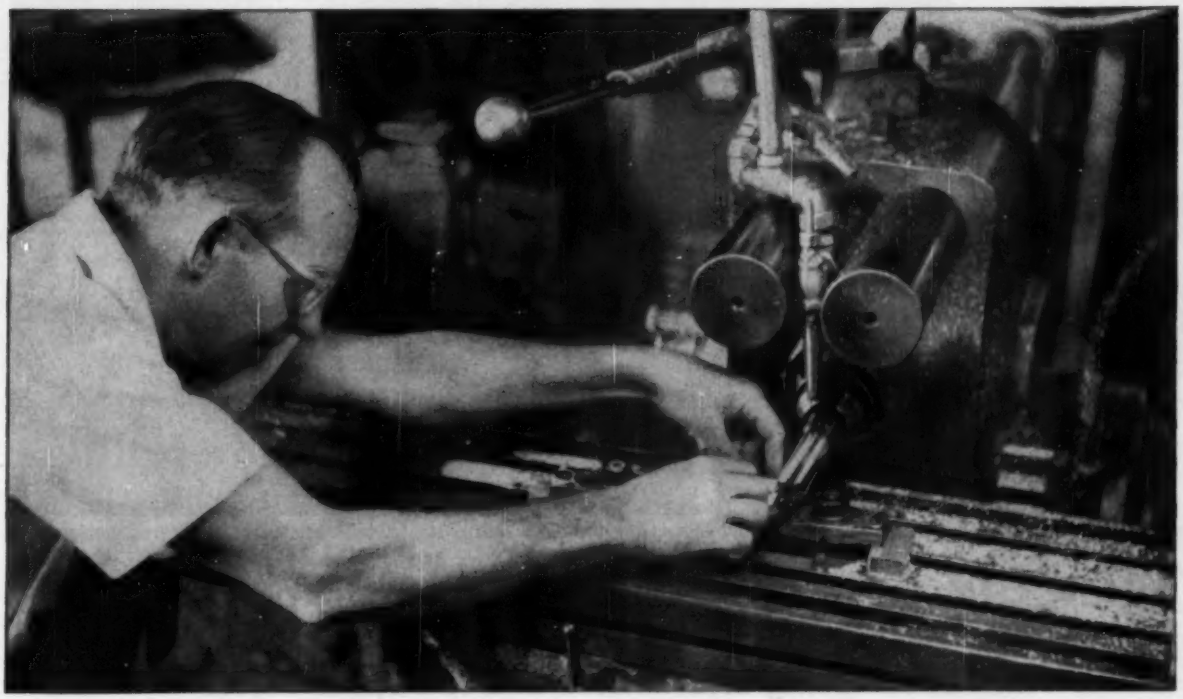
The home of PRECISION CENTER **Brown & Sharpe**

MILLING, GRINDING, AND SCREW MACHINES • CUTTERS
MACHINE TOOL ACCESSORIES • PRECISION TOOLS • PUMPS

◀ **Aerocycle,** a one-man helicopter now being tested by the U. S. Army, is one of the many aircraft for which Aeroaffiliates machines precision parts.

Some Examples of Aeroaffiliates' Work. ▶ All require fine tolerances and excellent finish. All were made with the help of Cities Service Chillo Cutting Oils.





"Fine Tolerances! Excellent Tool Life! With Cities Service Chillo Cutting Oil"

In probably no other machining operation are the tolerances so fine, the requirements so demanding as in aircraft work . . . especially when it's for the U. S. Army or Air Force.

But it is on such work that Aeroaffiliates, Inc. of Fort Worth, Texas, has become famous.

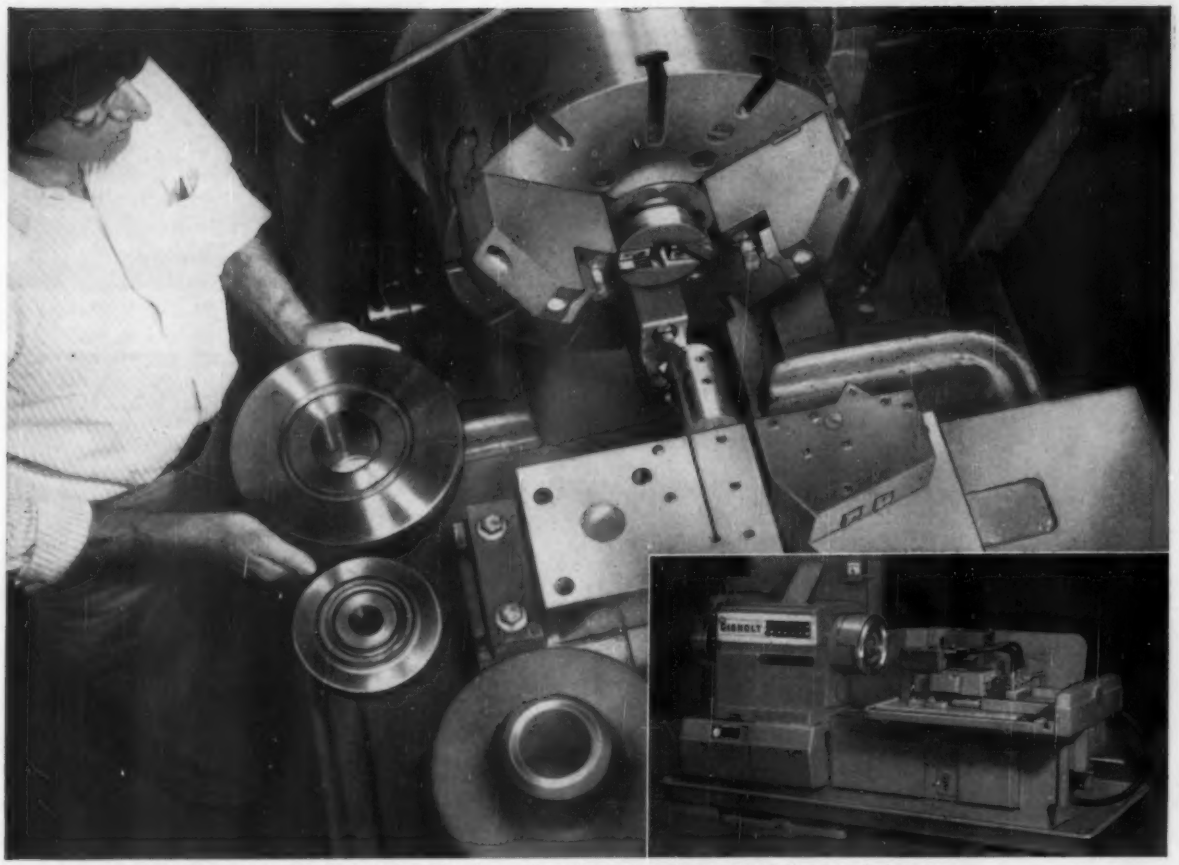
Every day, Aeroaffiliates employees must work with tolerances as fine as .0001, and their products must have an unusually good finish . . . so good that they are measured by a special gauge before the aircraft industry will accept them.

Obviously, this could play havoc with tool life . . ."but thanks to Cities Service Chillo Cutting Oils, tool life and finish are the best ever," says Aeroaffiliates. "These cutting oils are equalled only by the help we receive from the Cities Service Lubrication Engineer, a man whose knowledge and help we greatly value."

Whatever *your* type of machining operation, there's a Cities Service cutting oil tailored precisely for it . . . and a Cities Service Lubrication Engineer to help you choose it. Call him in this week. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS



Smart planning on Simplimatic holds f.t.f. time to 1.7 min. on 6½" diam., 3.3 min. on 10¾" diam. workpieces.

How OTM Corp. cuts costs machining parts in 13 sizes

Handles each part in single chucking, using Simplimatic with back-facing attachments and two-speed motor

You may get ideas from the way OTM Corporation, Houston, Texas, machines steel welding neck flanges and welding necks—with each part in 13 different sizes—completing each part in a single chucking and holding change-over time to an absolute minimum.

Here's how the job is done on a Gisholt Simplimatic Automatic Lathe: Facing, grooving, boring and chamfering operations are performed from tools on short tool slides, with T-slotted tops for quick adjustment. Relieving the boring tool at the end of the cut eliminates tool tracks. Simultaneously, a special back-facing attachment works through the spindle to shave-face and chamfer the O.D. on the hub. A power chuck wrench operates the scroll chuck and permits mounting this attachment in the spindle bore. A two-speed motor provides correct surface speed and permits switching from high speed (for turning and facing) to low speed (for grooving operation) and back again, during the Simplimatic's automatic machining cycle.

Here, again, the Gisholt MASTERLINE Simplimatic Automatic Lathe saves a manufacturer the cost of a special machine. Its extra wide platen table provides ample space for an infinite number of slide and tool arrangements—and its table feed permits tools to engage with the work or perform additional machining operations before actual slide movements begin. Ask your Gisholt Representative to show you how the Simplimatic performs special machine functions at standard machine prices—on your product and under your production conditions.

MASTERLINE GISHOLT SINCE 1887 GISHOLT

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin, U.S.A.

WRITE GISHOLT TODAY for new Catalog 1159-A on Gisholt MASTERLINE Simplimatic Automatic Lathe. Shows 31 typical jobs—fully illustrated.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTICS

Keep cool with CIMCOOL!

Getting hot about your production schedule? Cutting problems got you in a sweat? Relax, fellow! Cool off by putting CIMCOOL® on the job in your plant. CIMCOOL Concentrate is the largest selling chemical cutting fluid in the world. Here's exactly how it can increase your production and save you money:

- **CIMCOOL LOWERS COSTS** because it's longer lasting in machines. Thus, it reduces downtime and cuts labor costs for cleaning and changing.
- **CIMCOOL DOES A BETTER JOB** because of its chemical lubricity. It permits faster speeds and feeds, for it combines friction reduction and cooling capacity in a degree never before attained by old-fashioned coolants.
- **CIMCOOL IS CLEAN,** doesn't soil hands or clothing. It contains no skin irritants. It leaves no slippery film on shoes, floors, machine or work. It can't smoke, can't burn, and virtually eliminates rancidity and foul odors.

So don't fret yourself into a sweat. See your CIMCOOL distributor. He'll give you full information on *all* the advantages of CIMCOOL Concentrate—as well as details on the entire family of CIMCOOL Cutting Fluids.

Or contact us direct and we'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

*Trade Mark Reg. U.S. Pat. Off.

CIMCOOL CUTTING FLUIDS

CIMCOOL **Concentrate**—The famous pink fluid which still covers 85% of all metal cutting jobs. Effective, economical and clean.

CIMCOOL **Tapping Compound**—Permits the use of highest tapping speeds and increases tap life amazingly.

CIMPLUS The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.

CIMCUT **Concentrates** — For jobs requiring oil-base cutting fluids. Added to mineral oils, they give economical mixes for higher speeds and feeds.

CIMCOOL **Bactericide** — The most effective agent yet developed to overcome rancidity and foul odors.

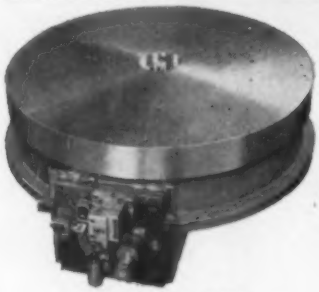
CIMCOOL **Machine Cleaner** — The two-phase non-corrosive cleaner that removes grit, dirt, slime and oil.

CIMCOOL Cutting Fluids

for 100% *of all metal cutting jobs*

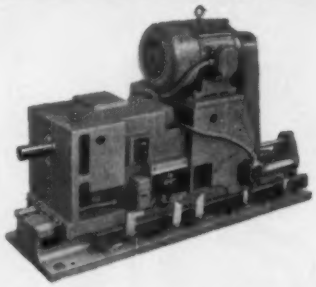
PRODUCTION-PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.

BECAUSE MAJOR COMPONENTS



STANDARD
ROTARY INDEX TABLE

available in 4 different table diameters, any practical number of indexes . . . permits use of a variety of work-holding fixtures . . . adapts to other machine designs.



STANDARD
WAY-TYPE DRILL UNIT

for drilling, boring, reaming, counter-boring and chamfering. Single and multiple spindle arrangements, single or double feed rates.

KEARNEY & TRECKER TAKES OF PRODUCTION

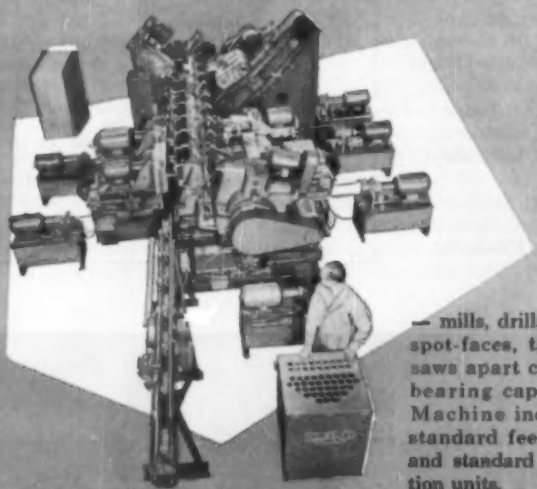
Here's a sound, proven *economical* approach to your production machine tool problems... Kearney & Trecker production machine tools featuring standardized components.

You get IMPORTANT SAVINGS — benefit directly three ways: (1) lower initial cost; (2) less lead time needed and (3) proven standard units mean efficiency *plus* simplified maintenance.

Ask the Kearney & Trecker man — he'll show you more examples of standardized machine components in production machine tools — the keys to capturing more profits from production!

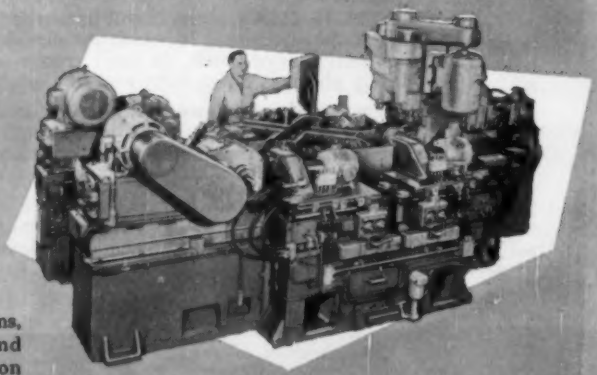
Integrated standard components meet

THIRTEEN STATION
AUTOMATIC TRANSFER MACHINE



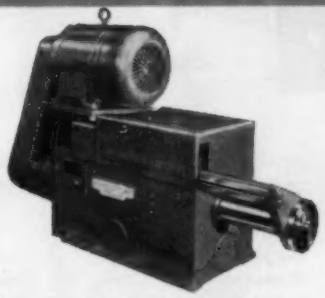
— mills, drills, reams, spot-faces, taps and saws apart cast iron bearing cap blocks. Machine includes 5 standard feed slides and standard production units.

FOUR STATION
ROTARY TRANSFER MACHINE



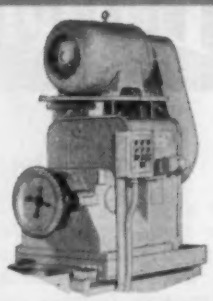
— New rotary transfer design permits machine to mill and center drill the ends and mill locating notches on crankshafts. Four standard feed slides, 3 standard production units are used.

ARE STANDARDIZED . . .



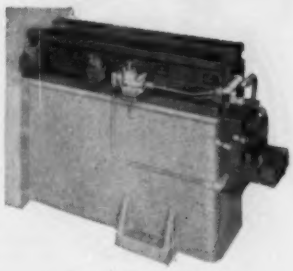
STANDARD QUILL FEED UNIT

for drilling, boring, reaming, spotfacing, counter-boring, chamfering. Single or multiple spindle arrangements — single or double feed rates.



STANDARD MILLING HEAD UNIT

4 sizes. Single spindle . . . various horsepower and speed ranges . . . Single or double reduction drive . . . automatic quill retraction. Any size can be modified for boring.



STANDARD FEED SLIDE UNIT

provides hydraulic feed for milling, boring or drilling heads. Available in four sizes; various length cylinder strokes.

THE "SPECIAL COSTS" OUT MACHINE TOOLS

ASK FOR FREE KEARNEY & TRECKER
Production Machine Tools Bulletin SMD-57.
It provides full standardized component details — and their application to production machine tools.

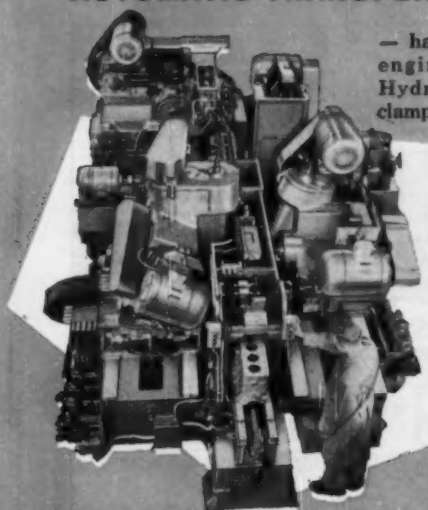
KEARNEY & TRECKER CORP.
6786 West National Avenue
Milwaukee 14, Wisconsin

KEARNEY & TRECKER MILWAUKEE

Designers and Builders of Precision and Production Machine Tools Since 1898

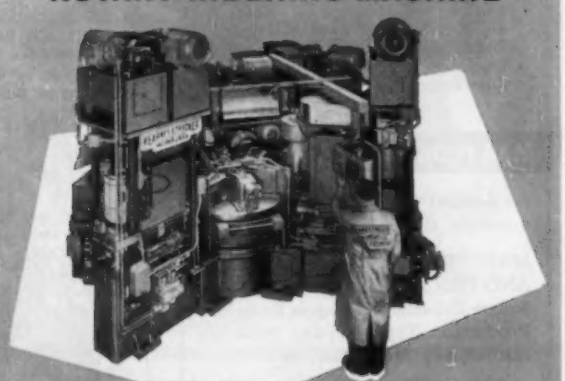
multiple machining requirements

SIX STATION AUTOMATIC TRANSFER MACHINE



— handles two different engine cylinder blocks. Hydraulic locating and clamping fixtures are a feature of this Kearney & Trecker which mills the mounting pads, push rod cover face, ignition boss, fuel pump pad and ends of blocks. Machine has 2 standard feed slides—4 standard milling heads.

SIX STATION ROTARY INDEXING MACHINE



two such machines replaced six obsolete tools for a communications equipment manufacturer. Basically 70% standard, machines incorporate 7 Kearney & Trecker standardized components. Use of overhead hydraulic units saves floor space.

HERE'S ALL IT COSTS

TO CUT A KEYWAY

WITH THIS HANDY KIT

With a *Minute Man* Keyway Broach Kit you can cut a keyway for as little as one cent in just *one minute*. Handles keyways from 1/16" to 1" in any bore from 1/4" to 3".

Minute Man Broaches for square and hexagonal holes and Production Type Keyway Broaches are also available from stock at your Industrial Distributors'.

MAIL TODAY - SAVE TOMORROW

The duMONT CORPORATION, Greenfield, Mass.

MAIL FREE BROACH CATALOG AND PRICE LIST A, describing Square Broaches, Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

Name.....

Company.....

Address.....

Letters...

To American Machinist
330 W 42nd St, NY 36, NY

Cookie Cutters

Dear Sirs:
Your News Report (*AM*—Apr 8 '57, p160) talks of a "cookie cutter" technique of blanking die construction. Is there any source of more information on this process?

Compliments on keeping yours the top magazine in the field.

S P Banigan
Port Washington, N Y

Dear Sirs:
. . . Please advise the address . . . to obtain further detailed information regarding "New Die Techniques. . . ."

J Taylor
Fort Erie, Ontario

The application referred to in this news item and in the accompanying illustration was made by General Motors. However, this is only one of such applications. Among other companies using the technique are A O Smith and White Motors.

The process for making "cookie-cutter" dies, which are also spoken of as "steel-rule" dies, is patented by Templet Manufacturing and is available under license agreement.

For further information, we suggest you contact Templet Manufacturing Corp, 160 Flushing Ave, Brooklyn 5, N Y—Ed.

Dye Penetrant Inspection

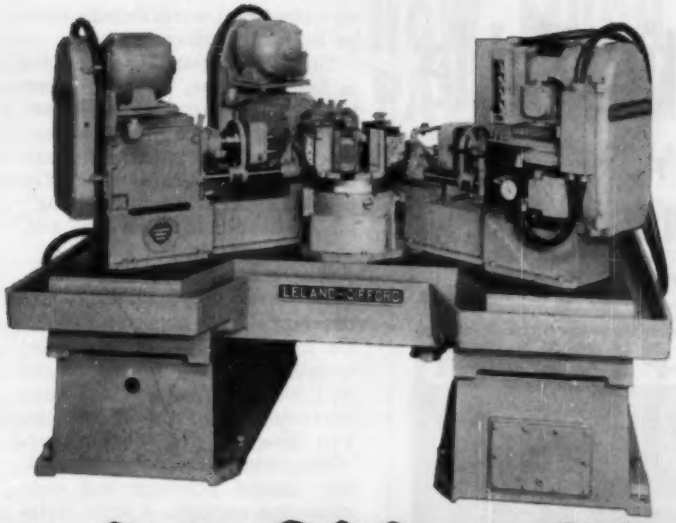
Dear Sirs:
To help you maintain the high quality of your editorial material, I am taking the liberty of correcting several statements made in your Reference Book Sheet, "Dye Penetrant Inspection . . I," by W D Briggs (*AM*—May 6 '57, p157).

The text which we believe requires altering now reads as follows: "Initial methods used in removing these deposits consisted of vapor blasting or liquid honing the part until all scale and oxide had been removed. These operations tend to fill very fine flaws with insoluble particles. Additionally, the abrasive particles can peen the metal surface to such

SHOPMATES

N. Jarvis

DON'T MIND THAT SWAGGS-- IT'S ONLY OLD MAC'S OVERALLS -- THEY'RE SO DIRTY THEY STAND BY THEMSELVES--
THOSE DIRTY PANTS HAVE CERTAIN ADVANTAGES-- MAC'S THE ONLY ONE IN THE PLACE WHO CAN SIT DOWN STANDIN'UP--
BESIDES--- THEM PANTS CAN OPERATE THAT LATHE BETTER'N MAC EVER COULD!!
HE LEAVES 'EM LIKE THAT WHEN HE CLIMBS OUT OF 'EM!!
ER STAND UP SITTIN' DOWN
J. Swaggs

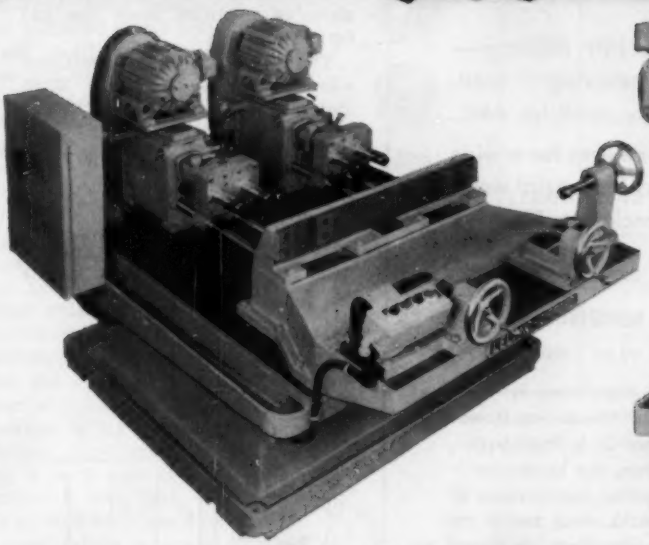


Mechanize Hand Operations

THE JOB — Drill and ream four holes on the face and two ends of automatic transmission valve body.

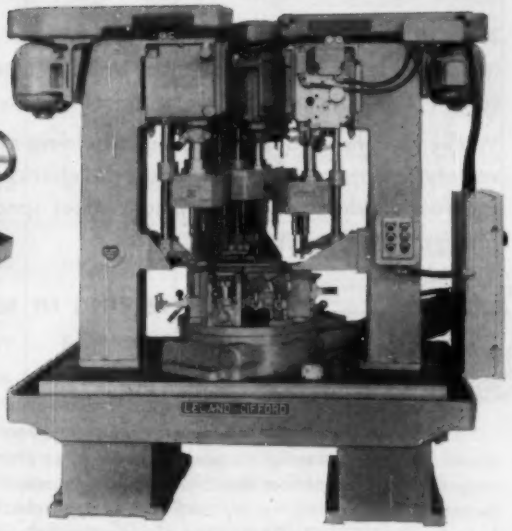
THE SETUP — Three No. 2 self-contained deep hole units with 2-spindle multiple heads and a 5-station hydraulic indexing station. Production: up to 120 pieces per hour.

LELAND-GIFFORD *Special Drilling Machines*



THE JOB — Drill and ream two .750/.751 dowel holes in 4 and 6-cylinder engine blocks.

THE SETUP — Two No. 3 self-contained units with 2-spindle heads mounted on a special base with work holding and positioning fixture.



THE JOB — Drill and ream 9 holes in one face and 2 deep angular holes in one side and one end of a control valve housing.

THE SETUP — One No. 3 and two No. 2 self-contained units with multiple heads vertically mounted over a 2-station automatic indexing table.

Contact the office nearest you for help with your drilling problems.

LELAND-GIFFORD
Drilling Machines
WORCESTER 1, MASSACHUSETTS, U.S.A.

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2515 West Peterson Ave.
DETROIT
10429 West McNichols Rd.
CLEVELAND 22
P.O. Box 853
NEW YORK OFFICE
75 South Orange Ave.
South Orange, N. J.
LOS ANGELES OFFICE
2620 Leonis Blvd.
Vernon 58, Cal.
INDIANAPOLIS 6, P. O. Box 1051
ROCHESTER 12, P. O. Box 24, Charlotte Station

Walker Magnetic Table

FOR

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★ LAYOUT

★ INSPECTION

This 36" x 96" magnetic table for the aircraft industry — template, layout and inspection work — timesaving — accurate — cost saving — highly practical unit for small lot work.

Walker engineers design and build holding devices for a wide variety of applications—many special chucks for special work. Put your holding problems up to Walker specialists. They will give you the answer.

PIONEERING IN MAGNETISM

The longest and broadest experience is yours when you specify a Walker Chuck for it was nearly seventy years ago that O. S. Walker produced the first successful Magnetic Chuck. Since then, the know-how in magnetic holding devices has been evident in countless applications of rectangular, swiveling, rotary and special type chucks. And, within the last decade, the O. S. Walker Company engineers have perfected Special Vacuum Chucks to harness atmospheric force to all non-magnetic materials. The Walker line also includes, Demagnetizers, Magnetic Drivers and all types of Special Magnetic Lifts.

Walker engineers, ready to help you with your holding and lifting problems, are always as near as your telephone, Worcester, Massachusetts — PL 6-6293.

O. S. WALKER CO. Inc.

WORCESTER 6, MASSACHUSETTS

Original Designers and Builders of Magnetic Chucks

an extent that some defects may be bridged or obscured."

The first sentence appears to be in the past tense, when we have today at least 100 machines actively engaged in removing engine operation oxide, and heat treat scale. Also, the words "Vapor Blast" and "Liquid Honing" are registered trademarks and should be capitalized.

The second sentence is erroneous, since Vapor-Blasting has proven to be a superior method for inspecting carbide tools, frequently revealing minute cracks that are not disclosed by other methods. We have sold production machines for this purpose. When metal is ground or polished, the applied pressure and heat cause fine particles of loose metal to be forced and held in minute fissures. The hydraulic and erosive action of water and abrasive particles liberate all such materials, and capillary action holds only water in the minute fissure, thus appearing as a dark hairline. It is understood, of course, that the part receives a rinse operation after blasting to remove abrasive particles from the exterior surfaces.

The hydraulic action described above explains why the third statement is also contrary to our experience. Furthermore, for flaw or crack detection on aircraft parts, extremely low micro-in. finishes must be maintained. To preserve this finish, very fine abrasive is used. This abrasive, 1250 NVB, is three times as fine

Helpful Henry

by L. Hoppes

"Hey, Bossl wanta see an exciting card game?"

as face powder and has a major particle size of 10 microns and a specific gravity of 2.65. From this description, it can be readily seen that the mass inertia and peening effect would be negligible and incapable of bridging and closing surface defects.

H F Patin
Vapor Blast Mfg Co
Milwaukee, Wis

The terms "Vapor Blast" and "Liquid Honing" are so familiar that we slipped. They should be capitalized, of course, and we apologize for the oversight.

Whenever we deal with competitive processes, we want to be as fair as possible in presenting all approaches. Therefore, we are glad to have Reader Patin's point of view—Ed.

Moonlight Requisitions

Dear Sirs:

Here is an idea that might help to keep tool loss under control (*AM*—Apr 22 '57, p100).

A good many companies have long followed a tool policy under which small handtools, such as wrenches and screwdrivers, must be furnished by the employee, and the company furnishes the larger, more expensive tools that are used less frequently.

One such company requires that each employee furnish a tool box equipped with a lock. The employee makes a list of the tools he has in his toolbox, indicating which ones belong to him and which ones belong to the company. Then the company takes out an insurance policy to cover any losses resulting from breakage or pilferage.

Actual experience has shown that, if each man is required to furnish his own tools, losses can be kept to a very low figure. Even in cases where a company furnishes a complete set of handtools to each employee, losses can still be kept within reason; but the employee has to be made responsible for his tools and has to pay for any that are lost.

At the very least, you should keep the toolroom locked and issue keys to only those individuals who have frequent need for special tools. You can't leave it wide open and expect people to resist the temptation.

Name Withheld

HOW MUCH DO YOU REALLY PAY FOR MILLING CUTTERS?

Hidden costs make inserted blade cutters more expensive than you think!

HERE'S PROOF!

One piece Carbide Tipped cutters have many advantages over inserted blade cutters-better finishes . . . more rigidity . . . closer tolerance milling . . . and one piece safety.

Now here is *proof* that solid cutters also save money hour after hour . . . day after day. Don't be fooled by the "do-it-yourself" replacement blade cutters-they're more expensive than you think.

NELCO Cutter Number	TOTAL COST NELCO Solid Tipped Cutter	Replacement Blade Cutter	COST Equivalent Replacement Blade Cutter	COST of set of Replacement Blades*	REMARKS
6104S	31.00	A	75.00	18.00*	Cost of Complete do-it-yourself cutter and two sets replacement blades $111.00 + replacement and grinding. Cost 3 NELCO Cutters $93.00.
14112F	140.00	B	336.00	84.00*	Cost of Complete do-it-yourself cutter and two sets of replacement blades $504.00 + replacement and grinding. Cost 3 NELCO Cutters $420.00.
12206-1	50.50	C	116.00	40.48*	Cost of Complete do-it-yourself cutter and one set of replacement blades $156.80 + replacement and grinding. Cost of 2 NELCO Cutters $101.00.
10306-½	37.00	D	129.00	33.12*	Cost of Complete do-it-yourself cutter and three sets of replacement blades $228.36 + replacement and grinding. Cost of 4 NELCO Cutters $148.00.
10108F	86.00	E	292.00	102.58*	Cost of Complete do-it-yourself cutter and four sets of replacement blades $702.32 + replacement and grinding. Cost of 5 NELCO Cutters $430.00.

*Figures above do not include removing old blades, inserting new blades and grinding.

FIRST COST IS LAST COST with a NELCO one piece Carbide Tipped Cutter: No expensive downtime to remove, replace and regrind inserted blades. Every NELCO cutter is ready to use-without delay . . . without added "hidden costs!" A spare NELCO cutter costs far less in every way!

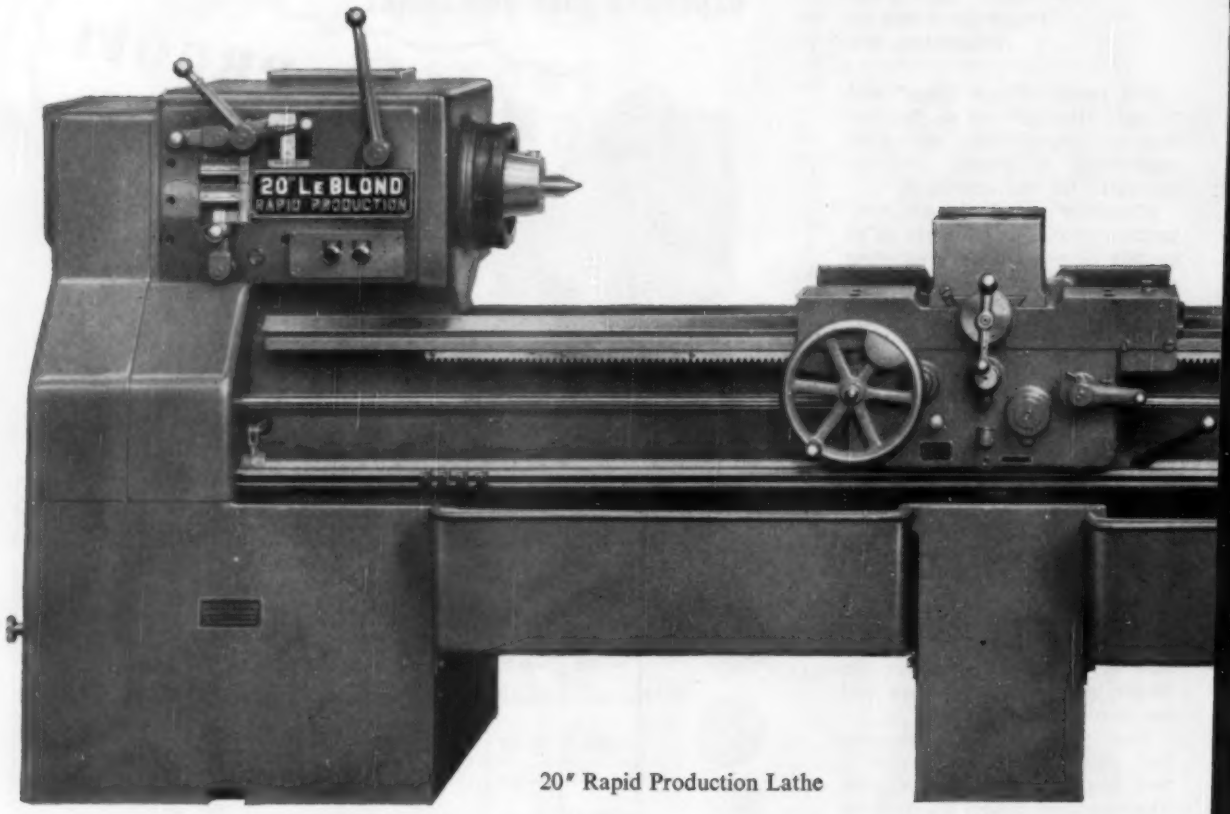
Send today for the New Nelco Catalog showing over 700 carbide tipped cutting tools.

NELCO TOOLS

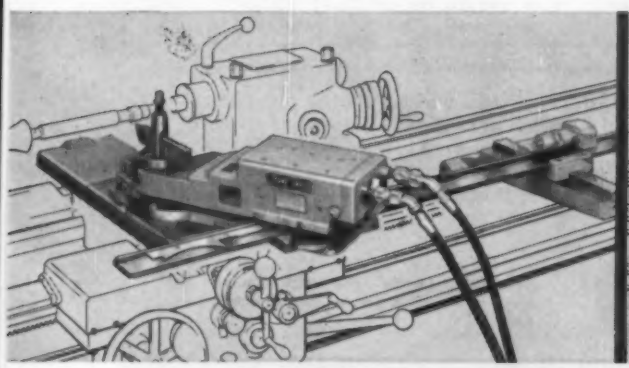
For that EXTRA Edge in Production!

Nelco Tool Co., Inc. • Manchester, Conn.

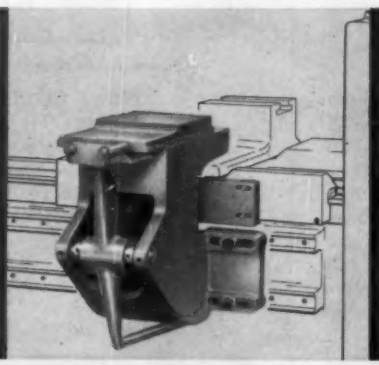
Another ALL NEW



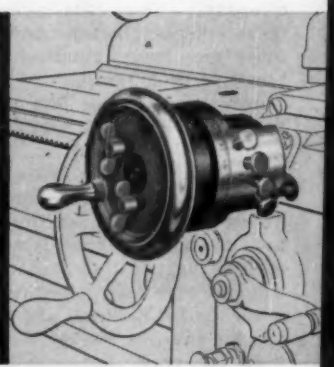
20" Rapid Production Lathe



HYDRA-TRACE®. LeBlond's exclusive hydraulic duplicating attachment can be installed in minutes. For stepless form turning, contour facing, turning step shafts, etc. Transforms the Rapid Production into the most economical Tracing Lathe in its class!



Automatic Facing Attachment. Permits two simultaneous operations from front and rear. While straight turning with front tools, attachment faces automatically using rear tools.



Multiple Positive Cross Feed Stops, Style B. Used for facing steps and duplicating diameter settings. Four adjustable stops are built into cross feed bushing. Will perform repetitive work accurately.

LeBLOND

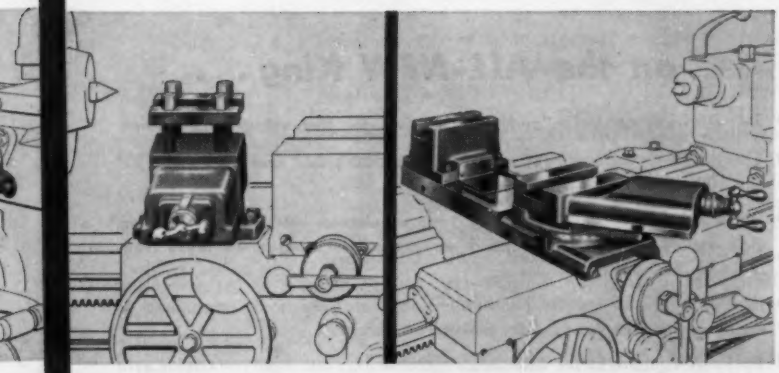
Low-cost manufacturing lathes with custom features to suit your specific turning jobs

Design your own manufacturing lathe—with the features and attachments you want. No extras to buy, only what you really need to do your job!

Here's how it works: The basic machine is either the new 17″ or 20″ LeBlond Rapid Production Lathe, designed from the ground up specifically for manufacturing assignments. They are *not* stripped down engine lathes. They *are* fundamentally simple, so that you can add the features you want. Ruggedly built, too, with all the basic LeBlond construction that assures dependable performance for many years.

From there on, it's your decision. First—your choice of speed ranges. On the 17″, 70 to 700 rpm or 105 to 1050 rpm. On the 20″, 57 to 600 rpm or 85 to 900 rpm. Next—your choice of any or all of these specific features: Hydra-Trace® hydraulic tracing, automatic facing, air-operated chucks, quick-acting tailstock, connected rests, taper attachments, turret tool post, cross and length stops, many more.

You'll find that with these custom features, you can design exactly the lathe you need to give you maximum production capacity per dollar investment. A lathe precisely suited to your manufacturing needs! Before you buy a manufacturing lathe, be sure to check the new LeBlond Rapid Production Lathes. Ask your LeBlond Distributor or write for Bulletin RP-220A.



Full Swing Rests. Makes full use of swing capacity over carriage wings for turning large diameter work. May be used with the compound rest for double-diameter turning on large gears, pulleys, etc.

Compound and Plain Connected Rest. Permits one-time set up for turning and facing step shafts. Rear facing tool operates alternately with front turning tool, without tool changing.

...cut with confidence

LeBLOND of Cincinnati

The R. K. LeBlond Machine Tool Company
Cincinnati 8, Ohio

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They ALL want to know about the NEW

Electrically Controlled

KING

Full Electrically Controlled 36" King with Turret Head, Side Head, and Complete-Unit Coolant Pan. The New Kings are available in sizes 30", 36", 46", 56" and up, in a wide variety of head combinations, with or without side head.

Production Engineers, General Managers, Shop Superintendents, Foremen, and other operating and executive personnel in more and more plants are taking a close, *close* look at the all-new, Full Electrically Controlled King® Vertical Boring and Turning Machine. And they *like* what they find . . . things *you* ought to know, too!

It adds up to this: the new King® will give you a *greatly increased production capacity* for your boring and turning work —a production capacity that is a "must" to meet stiffer competition in these days of continuously stepped-up speed in machine tool operation and control.

For full details on the new King see your King Distributor, or write us direct . . . *now!*

on the ALL-NEW King . . .

- **Full Electrical Control**—"pushbutton" speed for fast set-up and control.
- **Greater Power Reserve**—40 and 50 HP on 30", 36" and 46" sizes; 75 and 100 HP on sizes 56" and up.
- **Expanded Speed and Feed Ranges**—pre-selective with direct-reading dials for 24 speeds in any one of three standard ranges, 24 feeds from .0016 to .250 per revolution.
- **New Spindle and Spindle Mounting**—table stability that establishes a wholly new higher standard for maintained accuracy.
- **Optional Equipment for Additional Increase in Productivity**—Automatic Cycling . . . Automatic Positioning of Heads . . . Automatic Tracing Control of Heads . . . Power Rail Clamping.

AMERICAN STEEL FOUNDRIES, KING MACHINE TOOL DIVISION
1150 TENNESSEE AVENUE, CINCINNATI 29, OHIO

KING Vertical Boring and Turning Machines

Spot news...

- **One whole section of a plant will be made vibration free** in Lockheed's new Missile Systems Division plant at Sunnyvale, Calif. Reason: it will house ultra-sensitive reflectivity measuring instruments.
- **Automation will be theme of U S Government exhibit** at St. Erik's Fair, Stockholm, Aug 20. A tape-controlled American machine tool will be shown.
- **You cannot sue a labor union in Canada now.** That's the recent ruling of Canada's Supreme Court, which ruled that a union does not have "contractual capacity" and thus cannot incur "liabilities in tort." But labor leaders are sueable, the Court ruled, if they act in bad faith.
- **Japan expects its automobile production to increase 40-90% this year,** according to a report from Tokyo released by the consulate in San Francisco.
- **First zirconium welding fittings** (1.5-in. OD with 0.065-in. wall), designed for a nuclear energy application, have been forged by Tube Turns Inc of Louisville. Zirconium fittings were used because of stability under radiation.
- **First order for British goods from Red China since the embargo** was recently lifted went to Austin Motor Co for 76 long-wheelbase truck chassis to be used on undeveloped roads. Bodies will be added in China.
- **West Coast so far isn't suffering from defense aircraft cutbacks.** Most airframe producers say military backlogs, ranging from $1 billion to $9 billion, will carry them through 1958. Research programs haven't been canceled in most plants. But subcontracting has dropped as work is pulled back in.
- **Time and cost-saving method of dressing metal bonded diamond wheels** (and cleaning them, too) involves using a rubberized abrasive block. Because of its cushioned action, block "flows" around the diamond particles, removes smear metal and clogging without dislodging diamond particles. Method is said to restore wheel's cutting action in 1/10th usual time.
- **Comprehensive report on problems of numerical control,** involving two years' study by Aircraft Industries Association, has just been completed. Its salient points will be incorporated into a special section of "The Production Man's Guide to Numerical Control," an AM Special Report in the next issue.
- **Smallest gas turbine aircraft engine ever built,** produced by Solar Aircraft Co, San Diego, is 20-in. high, has a maximum dia of 15.5 in., weighs 50 lb, produces 55 shaft hp plus 12 lb of jet thrust, will power a one-man helicopter.
- **Possible new trend in auto materials?** One luxury nameplate's interior roof parts will be of glass fiber in '58.
- **A new system of position control for forging press heads,** developed in England, is reported to permit making of forgings to closer tolerances at faster speeds than ever before possible. Other advantages: cuts possibility of scrap, and allows less-skilled operators to be employed.

Spot index to major News stories...

By 1961—50% Planes, 50% Guided Missiles? 122
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No Diamonds Needed!

Ex-Cell-O Style 43-A Method X Tool Sharpener uses inexpensive cast-iron disk in place of conventional, but costly, diamond-faced grinding wheel.

XLO EX-CELL-O FOR PRECISION

Ex-Cell-O Method X Tool Sharpener Cuts Carbides Without Expensive Wheels

Compare the cost! Diamond wheel cost in off-hand tool grinding runs *eight to twelve dollars* per cubic inch of carbide removed. Wheel expense with Method X averages *only 20 cents.*

Compare the work! Method X produces no thermal stresses—won't chip or score carbide tips. Both carbide and shank are removed simultaneously—no need grinding secondary clearances.

Compare the operation! Operators can handle Method X Machines without special training. No pressure on the workpiece means less operator fatigue. Cutting speed (comparable to diamond wheel grinding) and desired matte finish—simply a matter of setting a power selector switch.

For full information on Method X send today for your copy of Ex-Cell-O's illustrated Bulletin #43272. Or ask your local Ex-Cell-O Representative for one.

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DETROIT 32, MICHIGAN
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MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

57-40

Washington ... NEWS REPORT

Arbitration ruling ...

The Supreme Court is clarifying the legal status of compulsory arbitration clauses in union contracts.

The Court, in a 7-1 ruling in three related cases, says that employers or unions in industries affecting interstate commerce may use the Federal Courts to force compliance with agreements to submit future disputes to arbitration.

The decision ends years of dispute and split rulings in the lower Federal Courts on the issue. It also frees unions from prevailing state law that agreements to arbitrate are not enforceable.

The three employers in the test cases all argued that the Federal Courts had no authority to compel arbitration. But the U S Supreme Court supported union arguments that Section 301 of the Taft-Hartley Act—permitting employers and unions to sue in a Federal Court for breach of a collective bargaining contract—applies to agreements to arbitrate.

China trade ...

Odds are rising that there may be some loosening of U S restrictions on trade with Red China. The British announced they were opening up their own trade—despite U S opposition—and it turns out that the reaction in Congress generally favors "a reappraisal" of U S policy.

Sizable markets are involved: British regulations now permit some 207 categories of goods to be sold there, including machine tools, instruments, trucks, locomotives, and other hard goods.

Many U S Industries that favor opening up the Chinese market will be heard from during hearings already quickly scheduled by the Senate Commerce Committee.

Military budget dilemma ...

Problem number one at the Pentagon—and in other Washington circles concerned with military procurement—is the administration's new policy to limit defense spending. A major shakeup in the current military budget is in the works, which would mean the cancellation or indefinite postponement of billions of dollars worth of procurement (See p126).

To hold down the spiralling level of expenditures—and thus stay within the debt ceiling—Defense Secretary Wilson is clamping down hard under orders from the White House.

He has banned "partially-funded" procurement —that is, starting production projects before enough funds have been authorized to back them up to the end. Objective of this—in the words of Defense Comptroller McNeil—is "sound program and financial management."

As a result of the large number of partially-funded contracts outstanding, McNeil's staffers claim, heavy cash outlays are coming due much sooner than anticipated by the Defense Comptroller. That's one reason why total defense expenditure figures are running so far ahead—at least $2.5 billion—of initial budget estimates.

The Services have been ordered to put aside enough funds still unobligated to support the outstanding partially-funded projects. Effect of this may be the cancellation of certain of these projects and delays in contracting for new ones.

Wilson has also set a definite ceiling on expenditures for the new fiscal year—the first time the Pentagon has seen such a policy since President Truman slapped one on before Korea.

Immediate results of the new policy are production cutbacks—the Pentagon prefers the more euphemistic term "stretchout."

Unions and the Fifth ...

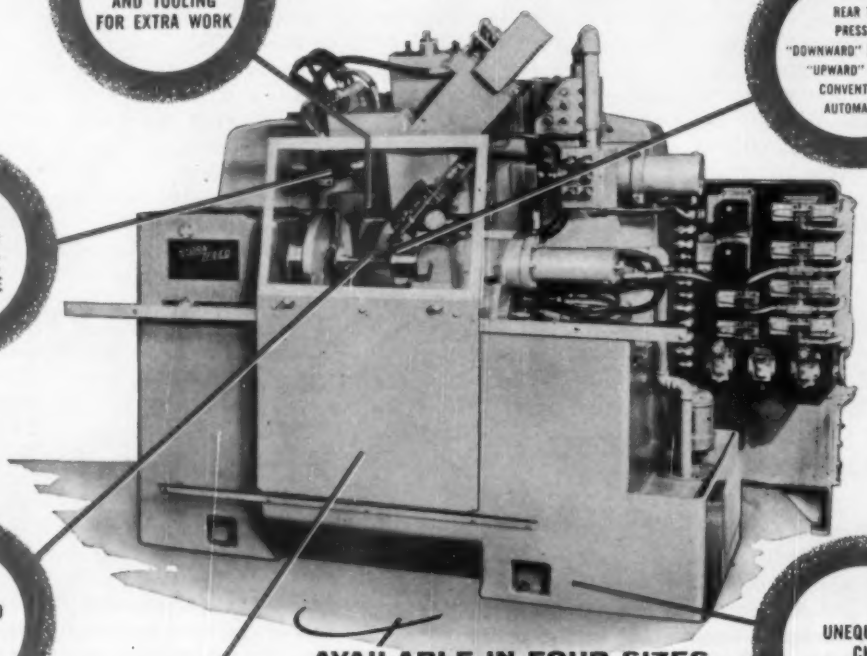
The AFL-CIO merger is in for some rough sailing ahead on racketeering. Just when union officials figured they held their own in the clean-up campaign with the firing of Dave Beck from the Federation's Executive Council, another and more potentially explosive case turned up. The accusations against Carpenter's President Maurice Hutcheson—exorbitant profits on the sale of land to the state of Indiana in collusion with state road officials—have stung the labor movement. Hutcheson is a powerful AFL-CIO Council member and if a fight develops within the "House of Labor" it could shake the foundations.

Machinist President Al Hayes sits on the hot seat. As head of the AFL-CIO Ethical Practice Committee he handles the racketeering cases. If he and Hutcheson's union should come to blows over this it could vitally affect the comparative peace between the Building Trades and the Machinists—a shaky peace at best.

AFL-CIO head George Meany was forced to act immediately when Beck took the Fifth Amendment before a Congressional committee, but is going slow on Hutcheson. The Carpenter's president, who had refused to testify about his alleged $15,000 profit in the land deal, might also be in violation of the labor code barring Fifth Amendment takers from union office. But, because the situation over Hutcheson is so touchy, the AFL-CIO will move very slowly, probably not taking up the case until August.

57-40

BULLARD HYDRA-FEED LATHES



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REAR TOOL PRESSURE "DOWNWARD" INSTEAD OF "UPWARD" AS ON CONVENTIONAL AUTOMATICS

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RIGIDITY AND POWER FOR HEAVY CUTS

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two models

Ruggedness, versatility and high production are outstanding advantages of the Bullard Hydra-Feed Lathes. Sizable reductions in finished piece cost are obtained with single setup machining of a broad range of complex shapes.

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286 CANFIELD AVENUE — BRIDGEPORT 9, CONNECTICUT

Detroit ... NEWS REPORT

GM to import small cars . . .

General Motors' recently announced plunge into the small car market was no surprise to Detroit, although the company had repeatedly denied it was planning such a move.

Affecting GM's decision to import English-built Vauxhall Victors and German-built Opel Rekords, beginning this September, were recent predictions that the U S market for foreign-made cars will hit 600,000 units a year by 1960.

Last year alone, Americans bought nearly 95,000 foreign autos. And sales so far this year indicate the total may reach 150,000 units.

Ford of England, for example, expects to sell between 25,000 and 30,000 cars here. American Motors hopes to sell 20,000 of its built-by-Austin-of-England Metropolitans in the U S. And Studebaker-Packard's American-built answer to the foreign car invasion, the new Scotsman economy model, is already doing better than expected.

Both the Vauxhall and the Opel Rekord, which are made by GM in Europe, will follow the design pattern of the most successful foreign-made cars sold in this country. Nearly 73% of imports sold here last year have wheelbases of about 100 in., putting them in the so-called "economy" class.

The Victor, which will be distributed by Pontiac dealers, has a 98-in. wheelbase. And while GM hasn't yet released specs on the Rekord, which will be handled by Buick dealers, its wheelbase is also expected to be about 100 in.

GM hasn't said anything about prices and expected sales, but has said that both cars will be "Americanized" in their styling.

Edsel news . . .

Ford is betting $250 million that its new Edsel line, scheduled for September introduction, will make the grade. If the Edsel should flop (and there hasn't been a successful new car offering since the 1920's), Ford should still recover half of its investment in still-usable plant and equipment. Actually, Ford has more at stake than money—it can increase its rate of growth only by getting a bigger share of the auto market.

The Edsel has been assigned that job.

Ford is shooting for a standard volume of 200,000 units per year for the Edsel, whose four series are expected to range in price between $2200 and $3600. The Edsel will be introduced by some 1200 dealers, and if it catches on, the dealer force will be upped to about 3000. Wherever possible, the Edsel will be sold through exclusive dealerships, and it will be dual-dealered with other Ford makes only if absolutely necessary.

Another UAW demand . . .

A bargaining table point that may figure prominently when contracts with auto companies come up for renewal next year involves benefits for workers who are nearing retirement age.

UAW is expected to ask management to cooperate in readying workers for retirement by (1) providing time off to attend counselling programs, and (2) helping finance such programs.

The demands are part of a long-range UAW program aimed at establishing a closer relationship with its retired members, who already number about 78,000 and will hit 100,000 soon.

To show it means business, UAW has set up a special department for this purpose, is channeling 2¢ of a 50¢ monthly dues increase into a special fund to support the retired and about-to-retire worker program.

Pre-previews on the 58's . . .

Ford Division gave automotive writers a peek at its 1958 models two weeks ago. Reason for the early preview: to scotch reports that the '58 Ford will only be facelifted, while rival Chevvy comes out with an all-new car.

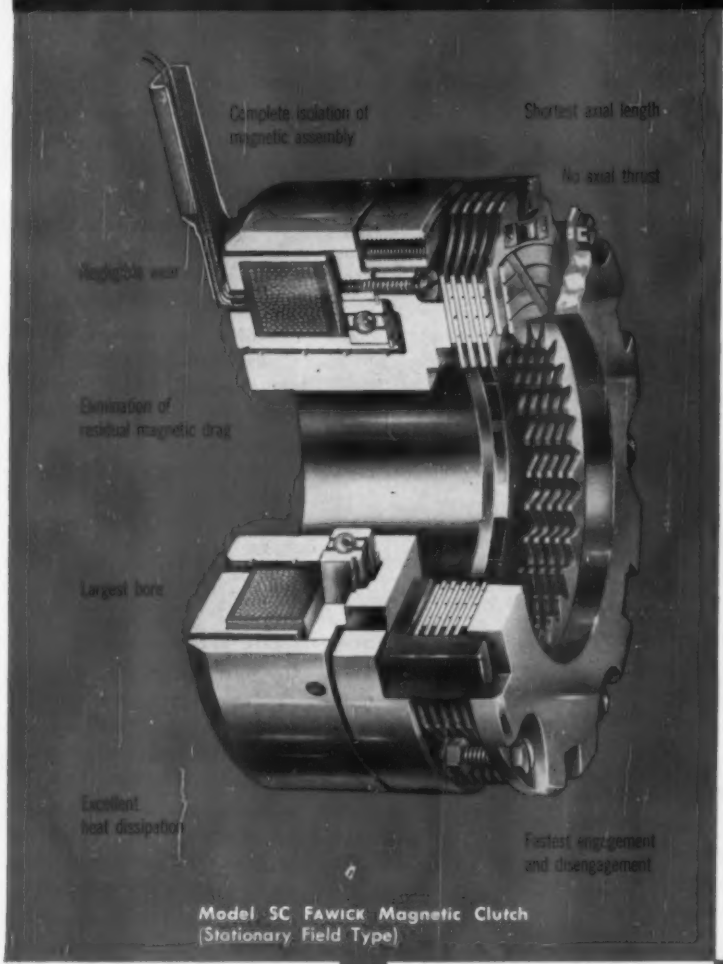
Ford is scheduled to bring out a four-seater Thunderbird in 1958. And Plymouth is rumored to have a "T-Bird" type car in the works, but its sport-type Fury would seem to rule that one out.

Fuel injection isn't likely to be much more popular on the upcoming 58's than it has been this year. Chevrolet is reportedly disappointed with reactions to it, and neither Ford nor Chrysler seems ready to move into fuel injection just now, although the picture could change overnight.

Hot air . . .

Stewart-Warner has come up with a device slated to speed up heat output of auto hot-water heaters. "Minit Heat" is said to pour 50,000 btu/hr into an engine's coolant system the second the motor is started. Result: "you get heat in one minute, instead of shivering for 14 minutes while the engine warms up." Price? $70.

FAWICK MAGNETIC...the *most adaptable* electric clutch



Model SC FAWICK Magnetic Clutch (Stationary Field Type)

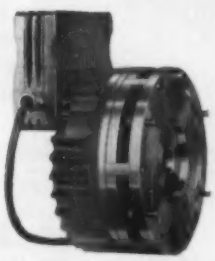
here's a clutch that really "fits in"!

In addition to their other great advantages, FAWICK Magnetic Clutches and Brakes are readily adaptable to either new designs or existing machines. They feature extra large bores, adaptable to any type drive, and their compact design minimizes space envelope requirements in all installations. They require no accessory components as they are completely self-contained.

They are applicable to wet or dry operation in sizes ranging from 2 to 13 inches in diameter, with torque ratings from 36 in. lbs. to 48,000 in. lbs. Standard operating voltage is 90 volts D.C., with other voltages available to specification. Write for Bulletin M-101 or contact your nearest FAWICK representative.

FAWICK AIRFLEX DIVISION
FAWICK CORPORATION
9919 CLINTON RD. • CLEVELAND 11, O.
In Canada, Fawick Canada, LTD., Toronto

Model SB FAWICK Magnetic Brake (Spring-operated, Electrically-released)



Model SBR FAWICK Magnetic Brake (Spring-operated, Electrically-released with Rectifier)

FAWICK Magnetic
INDUSTRIAL CLUTCHES AND BRAKES

Machine tools ... NEWS REPORT

New rental rates announced ...

New rental rates for government-owned production equipment leased to private contractors have been set by Office of Defense Mobilization.

The rates, which apply uniformly to all agencies start at 1¾% a month for machines up to two years old. For machines over two years and up to six, the rate is 1½% a month. Machines over six years and up to ten carry a monthly charge of 1%. Over ten years, the rate is ¾%.

The new schedule is to be used not only for contractors who pay cash monthly rentals, but for offsets in computing payments for military end items. One of the major purposes of the new rates is to make sure that lessees of government tools will not have a competitive advantage over contractors who own their own machines.

ODM's action in establishing new rental rates leaves some government officials unhappy.

No-package deal disappointing ...

Pentagon people wanted a 2% rental rate, but say that "we can live with it (the new plan)." More than that, they would like to be free to bargain in weapons-production contracts without being hedged in by the rental offset.

Other government people are disappointed that the recommendations of the inter-agency task force, embodying new rental rates, were not put into effect as a package. They wanted to see all lessees pay cash rental without offsets against government contracts. They also wanted a revolving fund, built up from rental money to finance replacement of old machines with new.

ODM says that approval of leasing of government tools for non-defense work will continue to be limited on a case-by-case basis to those situations that are in the national interest.

New orders sharply off ...

New orders for metal-cutting machine tools nose-dived in May to about $41 million, the lowest dollar volume since November 1954.

This figure represents a precipitate drop from April's $51 million and March's $59 million.

Net new orders amounted to $273 million in the first five months of this year. That is the equivalent of an annual rate of $660 million.

Shipments also declined in May to $78 million from the April level of $87 million. The industry shipped $409 million of metal-cutting machines in the January-May period. That is pretty close to a $1-billion-a-year rate.

June probably was not any better than May. In fact, the volume of new orders may not rise until September. Inquiries are heavy, but buyers are slow in translating them into orders.

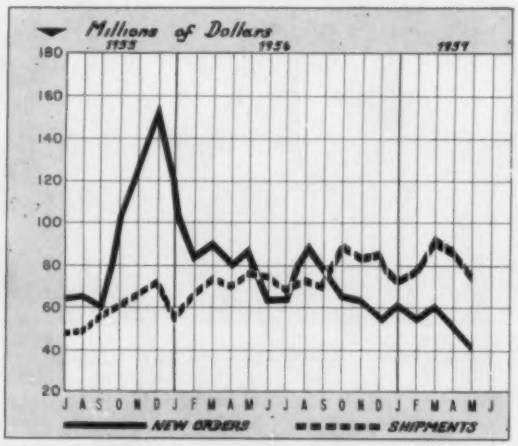
Air Force, incidentally, recently cancelled well over $10 million of orders for skin millers with two prominent builders. Reason is that rapid shift from planes to guided missiles cuts down the need for so many skin millers. The cancelled machines were not in production and represented future work, probably in 1958.

Gisholt forms British company ...

Gisholt has organized an English subsidiary known as Gisholt Machine Co (Great Britain) Ltd, with office and staff in London. New company will subcontract certain Gisholt balancing and superfinishing machines to be made for overseas markets. Albert E LaGrille is managing director and Hobart S Johnson II director and general manager.

DeVlieg jig millers are now in production at new Lutterworth, England, plant of Alfred Herbert. Special demonstration was given at Herbert's London showrooms in May. First British-built Heald internal grinder also was shown. A considerable range of Heald machines is to be made at Cincinnati's Birmingham factory.

BF



MACHINE TOOL ORDERS AND SHIPMENTS both dropped in May from April levels. New orders declined from $51.3 million in April to $41.5 million in May, while shipments dropped from $87.8 million in April to $78.7 million in May on the National Machine Tool Builders' Association Index

SUNDSTRAND MODEL 14 LATHE is controlled by G-E numerical positioning control and punched card input. Lathe is used for general step-shaft turning, providing both roughing and finishing of shafts. Positioned drives include longitudinal motion of carriage and vertical cross slide. Auxiliary programmed functions include card-sequence check, spindle speed, carriage speed, cross-slide speed, facing-tool speed, tool indexing, and cycle interruption.

WITH G-E NUMERICAL POSITIONING CONTROL

Programs are prepared in 1/10 the time, parts produced 51% faster—automatically!

Production runs on Sundstrand Machine Tool Company's Model 14 lathe have again proved the superiority of G-E numerical positioning control. To compare the performance of a G-E numerically controlled lathe with a standard lathe, 20 different parts were run on each type. Here are a few of the actual production results:

- **Machine set-up time** is practically eliminated with G-E numerical positioning control.
- **Average machining time saving** is 51%—ranges to 83% on individual parts.
- **Cost of data preparation** is 10 times *less* with G-E numerical positioning control.
- **Program preparation time** is only *one-tenth* that of the standard lathe.
- **High accuracy** is maintained repeatedly with G-E numerical positioning control. Electrical system carriage accuracy: ±.0025; cross-slide accuracy: ±.0005.
- **Over-all production time** is less due to fully automatic operation of G-E control system.

These performance results add up to faster, more accurate production—automatically!

WIDE RANGE OF APPLICATIONS

The amazing performance of General Electric numerical positioning control is not limited to lathe applications such as this. The G-E system can be applied to *any* machine which requires positioning of linear or rotary motion members from one point to the next. Thus, G-E numerical positioning control is applicable to many machines in metalworking, plastics, paper, textile, and woodworking industries.

COMPLETE LINE OF PROGRAM CONTROLS

All types of programming have application in today's industry, and General Electric offers you a complete selection of job-proved systems to help you convert from manual control to automatic machine control.

In addition to numerical positioning control, General Electric leads in the design and application of template tracer and numerical contouring control systems.

To learn more about how you can benefit from today's modern machines and machine tools controlled by General Electric program control systems, contact your G-E Sales Engineer today. And, for a complete description of G-E numerical positioning control, write to Section 795-1, General Electric Co., Schenectady, New York.

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Progress Is Our Most Important Product

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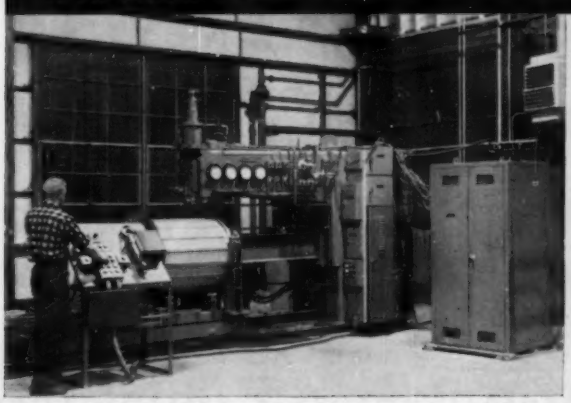
2 MORE APPLICATIONS OF G-E NUMERICAL POSITIONING CONTROL



Spot-welding machine

Turret-type punch press

FACTS

about

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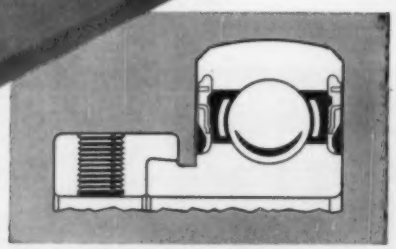
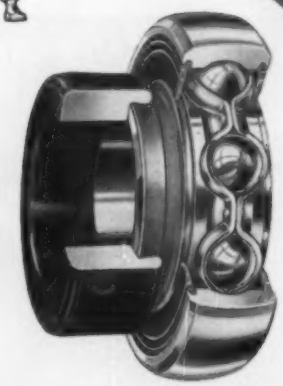


The bearings are easily applied to the shafting and are positively locked in position with an eccentric cam locking collar and set screw.



New Departure Pillow Blocks employ the performance-proved New Departure Type AE Adapter ball bearings with spherical O.D. for alignability and steel-reinforced Sentri-Seals for long life protection against dirt or grease leakage.

BALL BEARINGS MAKE GOOD PRODUCTS BETTER

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN.

What's ahead ... in Metalworking

NEWS REPORT

Good summer looms in Metalworking . . .

Metalworking is going into the summer producing goods at the highest rate on record for this time of year, except for World War II.

Operations top those in 1953, when the Korean defense program was at its peak. They also are slightly ahead of last year.

Defense work can claim the credit for this extraordinary showing. The big push behind metalworking operations currently is in the airplane and missiles industries.

High output of capital goods also is responsible for much of today's performance.

Nevertheless, backlogs are shrinking and in the months ahead durable goods may not be quite as strong a prop under metalworking activities as it has been in recent months.

Steel mill production will sink to the year's low point in August, but rapid upturn is sure in September. Plate and structural steel, as well as pipe, continue in strong demand. But flat-rolled steel and bars are lagging. Auto makers have begun to talk about 1958-model requirements, a good sign so far as steel people are concerned.

Casters expect upturn . . .

Gray iron casting business has fallen behind last year's record. But a substantial pickup is expected the second half, triggered by demand from the auto industry. Foundrymen point out that major impact of the road-building program is still to come.

Orders for stampings have continued to slide off, commercial stampers say. May volume was off slightly from April, which in turn was down 50% below March levels. Business generally is spotty.

Stampings are in good demand for business machines and office furniture. A recent gain is reported in TV tonnage, as sales of portable units stay up and new models are about to be put on the market. Some specialty types of stamping business are going well.

Poll of stampers by Pressed Metal Institute shows that 21% look for an upturn in the next three months, 46% foresee little change, and 35% anticipate a decline of 5% to 35%.

Material handling sales good . . .

New orders taken by material handling equipment manufacturers in the first four months of this year were equal to 30% of total bookings in all of 1956, Material Handling Institute reports.

Outlook is for sales to stay fairly close to last year's level, which was an all-time high.

Commercial heat treaters have disclosed that their production this year has been almost 9% above last year's dollar volume, Metal Treating Institute reports.

Tool and die shops are digging well into their backlogs, as production continues big and new orders drop off, National Tool and Die Manufacturers Association reports. Shipments have been running ahead of last year. But amount of work on hand is some 27% down from the year-ago level.

Work on tool and dies for 1958 car models has not yet ended. Shops expect that orders for 1959-model tooling will begin to flow in next month.

175

AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	JUNE Estimated	MAY Preliminary	APR. Revised	MAY Year Ago
Total Index	**175**	**175**	**176**	**167**
Machinery	153	152		149
Electrical Machinery	198	196		206
Autos	121	127		114
Other Transportation	142	145		136
Other Metalworking	142	145		136

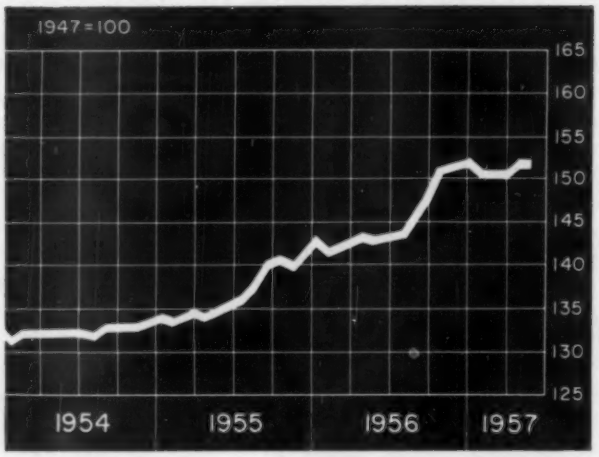
NEWS REPORT

What's ahead . . . in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	JUNE Estimated	MAY Preliminary	APR. Revised	MAY Year Ago
Total Index	**152.0**	**152.0**	**151.9**	**143.9**
Metalworking Machinery	**176.9**	**176.5**	**165.0**	
Other Machinery exc. Electrical	**161.1**	**160.6**	**151.0**	
Electrical Machinery	**153.9**	**153.9**	**142.6**	
Fabricated Metal Products	**143.3**	**143.4**	**137.5**	

152



Good summer for industrial production . . .

Industrial production is expected to stay fairly close to the level that has prevailed recently.

It is not likely to move down much during the summer months, after allowance is made for vacation shutdowns. Don't look for any gains either.

For May, the seasonally adjusted index of industrial production was at 143, the Federal Reserve Board reports (1947-1949=100). This represents a slight decline for the third straight month.

Don't forget that industrial output still is running a bit ahead of last year.

Whatever weakness exists can be traced largely to an easing in production of durable goods.

Manufacturers' sales and unfilled orders have been declining lately, with lowered shipments mainly stemming from durable goods.

A slight gain in new orders has given encouragement to those looking for favorable signs. Incoming business in nondurable goods has been sufficient to more than offset a drop in durable goods. The paring of backlogs has centered in the hard-goods field.

Inventories held by manufacturers still are rising, but are on a lower scale than has prevailed during the previous year. Metalworking accounts for a lion's share of the gain. The fabricated metal, machinery and aircraft industries are largely responsible.

Installment debt, a good barometer of consumer conditions, has gone up again. But the increase is less than in the corresponding period in either of the past two years.

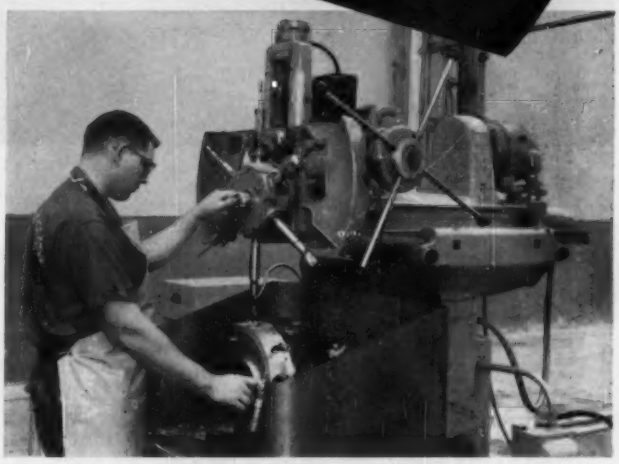
More than that, remember that installment debt normally goes up during the spring auto buying season. Total outstanding consumer debt added up to $41 billion on May 1.

WEEKLY BUSINESS INDICATORS	*Latest Week*	*Preceding Week*	*Year Ago*
Business Week Index of Activity (1947-1949=100)*	144.5	144.5	147.8
Steel ingot operation (thousands of tons)	2,240	2,214	2,290
Electric power output (million Kilowatt hours)	11,958	11,550	11,425
Production of automobiles and trucks	156,084	163,438	133,571
Engineering construction awards (Eng. *News-Record*—millions)	$370.8	$417.7	$443.5
MONTHLY BUSINESS INDICATORS	*Latest Month*	*Preceding Month*	*Year Ago*
Index of industrial production (1947-1949=100)*	143	144	141
Index of durable manufactures production (1947-1949=100)*	160	161	157
Durable goods manufacturers' sales, millions*	$14,100	$14,438	$13,519
Machinery manufacturers' sales, millions*	$ 4,103	$ 4,171	$ 3,740
Durable goods manufacturers' new orders, millions	$13,214	$13,524	$14,073
Machinery manufacturers' new orders, millions	$ 3,839	$ 4,032	$ 4,122

* Seasonally adjusted

CONVAIR *Brand* SWISS CHEESE *by* BURGMASTER® turret drills

Here's how CONVAIR managed this precision work: "The manifold consists of a multi-hole pattern in a magnesium disk over one foot in diameter and almost two inches thick. These holes, to be produced on both faces and the periphery, varied both in depth and diameter, requiring many single and combination tools and taps; all to be held to close tolerances. The solution to this task was found in a tandem of three ram type BURGMASTER radial turret drills. These versatile machines allowed us to produce all the required machining with a minimum of set-up, tooling, operation time, transfer time and maintenance."



The Burgmaster Model 2 BR (6 Spindle) Ram Type Radial Turret Drill with Automatic Power Clamping features power indexing and a new sensitivity in handling. When the ram is clamped in position, the 2 BR can function as a deep throat production turret drill, easily handling holes up to ¾". The machine has a 250° radial movement with maximum and minimum radii of 42" and 15", respectively.

For complete details, write Dept. AM-7.

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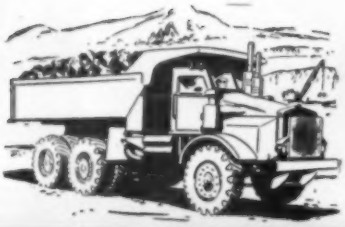

Better Cuts Make Better Fits for Road Machinery Builder

This rugged machine is in service two shifts — 16 hours a day — five days a week shearing parts of various thicknesses and shapes for heavy earth-moving equipment. It is rated for mild steel 12' x 1".

THE ease with which good, square, accurate cuts are obtained has made the Steelweld Shear of a road machinery manufacturer very popular with the operators and shop management.

Experienced with various type shears, they know the importance of easy knife clearance adjustment. They know that the best cuts are obtained when the correct clearance is provided for each thickness of plate being cut. As they point out, improper knife clearance on any shear often results in a heavy plate being cut at an angle with respect to the thickness, or light gauge metal burring.

Adjusting knife clearance on Steelweld Shears is such an easy, quickly-performed task that operators take care of it automatically. Turning a hand crank until a gauge pointer is on the proper metal-thickness figure is all that is necessary — a task done in a matter of seconds.

The big time saving made on knife changing as compared with most shears is another factor greatly appreciated. Easily done in two hours on a Steelweld, this job frequently requires all day on other machines.

Steelweld's unusual pivoted-blade operating principle makes possible outstanding cost-cutting advantages. For the complete story, send for the catalog below.

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STEELWELD PIVOTED BLADE SHEARS

American Machinist

MAGAZINE OF METALWORKING PRODUCTION · ESTABLISHED 1877

The Pause That Refreshes Ideas

It has been hotter than blazes. And it seemed that the heat wave would never end. In the midst of it, nothing was more delightful and stimulating than the pause that refreshes—whether it was a coke, a gin and tonic, or just plain cold water.

Competition in Metalworking has been getting hotter than blazes. No one can even make a good guess about how long the heat wave of competitive pressure will last. No doubt you have felt its withering winds.

Amid blistering competition . . .

why not pause and take a look round, and ahead? You may get some refreshing and stimulating ideas about what to do to keep on top.

These are days when traditional markets don't stay put. Detroit is going to have to do some fancy designing, producing and selling of cars if it expects to secure in the future as much of the consumer's dollar as in the past. Its competition ahead —cruises, sports, Florida vacations, new suburban homes, air-conditioning—is rugged.

It used to be that a military airplane was largely made up of an airframe, engine and firepower. Now, more than half the content and dollar volume go into electronic devices. The electronic percentage will grow year by year. Is the same kind of shift taking place, or likely to, in your line of business? How prepared are you to deal with it?

Mr Reuther is getting ready . . .

to make a big issue out of the four-day week. Back of it, we suspect, is the desire for more pay rather than more leisure. That means higher labor costs. What do you expect to do to offset the effect of these added costs, when they come? Better be thinking about it now instead of waiting until they are upon you.

A well-known machinery builder prices his product around $7500 and makes a handsome profit on it. Two competitors ask about $12,000 for the same type of machine. You know the answer to the question: Who gets the bulk of the business? How do your prices compare with those of your competitors? Do you have a safe profit margin? How long will it be safe?

This is the day of automation. Used intelligently, it can go far to lower your costs and increase your productivity. Used badly, it can cause an endless number of headaches and be very expensive. To what extent can automation help you? Have you surveyed its possible applications in your plant?

Progressive metalworking companies are not content to let old plants and old machines and old production processes hold them back. It is not unusual to see a manufacturer these days move bag and baggage to a new factory expressly designed and equipped for cost-cutting and precision work.

Neither is it noteworthy . . .

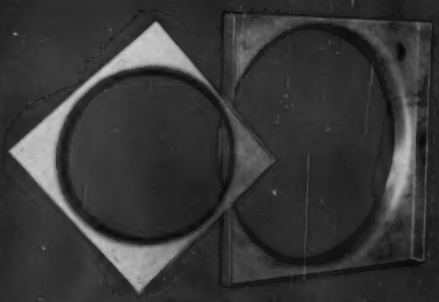
to hear about companies that revamp entire departments to get lower machining costs and easier and more economical flow of materials and subassemblies.

What condition is your shop in? Are you ready to meet the competitive pricing of companies that have spent generously to bring themselves abreast of latest techniques?

What we are getting at is simply this: It does not do any good to mop your brow and wish that cooler breezes would come along and drive away the competitive heat that may be contributing to your discomfort. The best thing instead is to pause long enough to figure out what you must do to live comfortably and prosperously with conditions as they are and as they probably will be for some time. The pause will refresh you and at the same time help insure long life for your business.

Burnham Finney EDITOR

Photos courtesy of Anchor Metal Spinning Company.



Typical fan housings produced by Anchor Metal Spinning Company

Money and Time are saved

by this accurate CINCINNATI PRESS BRAKE

. . . at ANCHOR METAL SPINNING CO., Dayton, Ohio

Profitable production has been achieved by installing this Cincinnati Press Brake. Accurate flanging of fan housings is done rapidly while meeting the rigid requirements for squareness. Operations on different sizes and gauges of materials are performed with ease. Parts for assembly are ready on time and smooth economical shop operations maintained.

Write Department A for Bulletin B-6 "30 Ton and 50 Ton Cincinnati Press Brakes".

THE CINCINNATI SHAPER CO.

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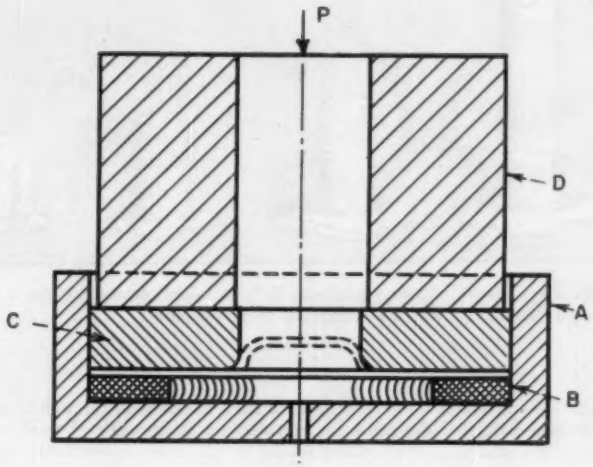


Fig. 1—In the "punch-less" method of drawing, rubber ring *B* flows inward under pressure and by friction moves the blank material into the die hole

Russians' "Punch-Less" Drawing Requires Fewer Operations

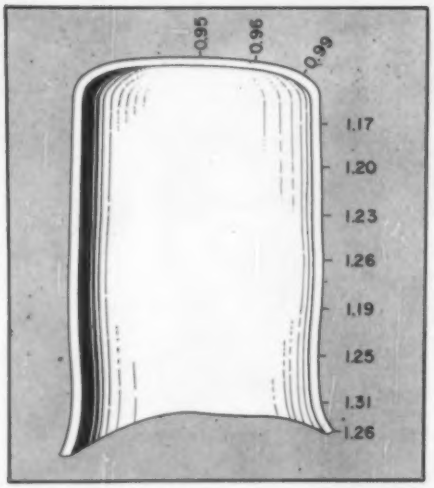
Metal can be urged into a die hole by friction forces acting radially inward when a rubber ring is compressed, according to N A Maslennikov in *Vestnik Maschinostroyeniya*, Vol 36, No 5, 1956, pp 59-63. The scheme can be used with a punch, too, when the usual clearance is increased. The original article apparently was a considerable abridgement of a long report, and essential facts seem to be missing. However, the approach is novel as it was when we published the first reports on Russian work with electrical discharge machining and with ceramic tools. We urge you to study this report, then form your own conclusions on the merits of the method

American Machinist

A process of deep drawing has been developed, in which the friction forces are reversed to assist metal deformation. Russian experience shows that the method reduces the number of operations required, by increasing the "draw-limit coefficient." In aluminum alloys, the coefficient was increased from a range of 2 to 2.5 to a range of 6.5 to 7, and the number of draws from eight to one.

To understand what is accomplished, consider first what happens in conventional deep drawing. High compressive forces must be induced in the blank's flange, so that metal will flow, crowd in and pass over the drawing edge. Bending forces occur as the metal moves into the vertical shell wall. Friction forces must be overcome, as the punch pulls the metal from under the blankholder. All of these forces increase the tensile stress that must be induced in the shell wall by the punch.

"Punch-less" drawing reverses the frictional force. The setup consists (Fig. 1) of: a container or body *A*, an elastic-friction clamping element *B* on which the blank is laid, the die ring *C*, and a pressure-transmitting cylinder *D* that is acted upon by the press ram. At the downstroke of the press, the rubber is compressed and of course is displaced toward the path of least resistance—radially inward. By friction, the metal in the blank



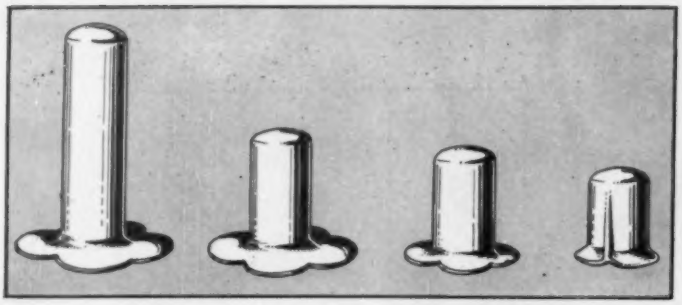


Fig. 3—These shells were produced by "punch-less" drawing. Note: a poorly printed photograph was the source for these sketches

Fig. 2—Sketch of a sectioned shell to show thickness of the wall at various locations. Note that the metal appears thickest at the neck

Russians' "Punch-Less" drawing . . .

is caused to flow over the drawing edge and up into the die cavity, provided the friction forces produced by the specific pressure are large enough.

A cross-section of a shell drawn by this method is shown in Fig. 2. Instead of the usual decrease in thickness, there was an increase in thickness at the dangerous area.

Experiments have shown that elastic-friction clamping elements made of rubber can develop sufficiently large friction forces in the clamping plane to produce the desired shape of the component in the die recess without using a punch. In addition, the elastic-friction element fully replaces the action of the blank holder. Fig. 3 shows sketches of components produced by friction forces without the use of a punch from blanks, whereby the extrusion coefficients (from right to left) were: 2.5, 3.5, 4 and 5.25.

The "total resistance coefficient" varies betwen $\mu = 0.2$ to 0.3 depending on the grade of rubber. (Note: the author defines as "the total friction coefficient" μ the difference between the friction coefficients of rubber to blank and blank to die. The value of μ increases with increasing hardness of the rubber.

Grades of rubber that prove most suitable are those that insure the highest active friction forces (while having the lowest residual deformation), possess a high wear resistance, and do not break up at relatively high compression values. Experiments show that rings 4.9 mm thick by 80 mm OD by 50 mm ID fail at the following loads: soft rubber (Grade No. 1) will show residual funnel-like deformation at a load of 45 tons; rubber of medium hardness (Grade No. 2) will layer along the face of the hole at a load of 55 tons; very hard rubber (Grade No. 3) successfully withstands 100 tons.

The rubber rings should deform uniformly throughout the entire thickness. This result can be obtained by selecting an optimum thickness of the ring. For the conditions during experiment the optimum ring thickness is 5 to 7 mm.

Correct choice of the ring's internal diameter is also of great importance, because it influences full utilization of the friction forces and product quality. The diameter of the ring must be chosen so that during deformation the rubber acts on the entire flange area of the blank including the lip of the die, but does not press on the bottom of the forming cup, to avoid tears.

On the assumption that the volume of the rubber before and after deformation remains constant, the following formula can be applied for determining the optimum inside diameter of the ring:

$$d_p = \sqrt{D_k^2 \delta - \frac{1}{3}\frac{d_M^2}{h_o}} \qquad (1)$$

where δ = the relative reduction of the rubber, or

$$\delta = \frac{h_o - h}{h_o}$$

d_M = diameter of die hole,

D_k = inside diameter of the body or chase, or OD of the rubber ring.

Use of the correct lubricant is of great importance. A suitable lubricant between the rubber ring and the bottom of the chase permits free and uniform displacement of the rubber. If a low-viscosity lubricant is used, deformation of the bottom layers of the rubber will greatly exceed deformation of the upper layers, which rub against the blank. This condition leads to an intensive extrusion pressure and also to tears in the lower rubber layers. If the body of the chase is not lubricated at all, the friction forces at the bottom and the top surfaces of the rubber ring will be so large that it will be pressed only towards its center section, until it disintegrates in layers.

Optimum lubricants are: (1) for contact between bottom of rubber ring and chase—70% rosin and 30% castor oil, (2) for contact between blank and die—50% rosin, 50% castor oil, and (3) for contact between the blank and rubber ring—powdered rosin.

NUMBER OF OPERATIONS

When the diameter of the blank is increased, the number of operations to make the shell will be increased. For blanks of equal di-

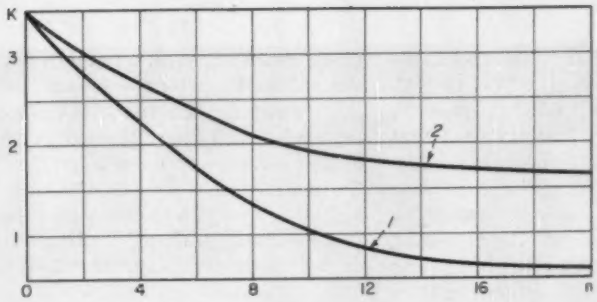


Fig. 4—Relationship of the coefficient of deep drawing K to the number of draws n

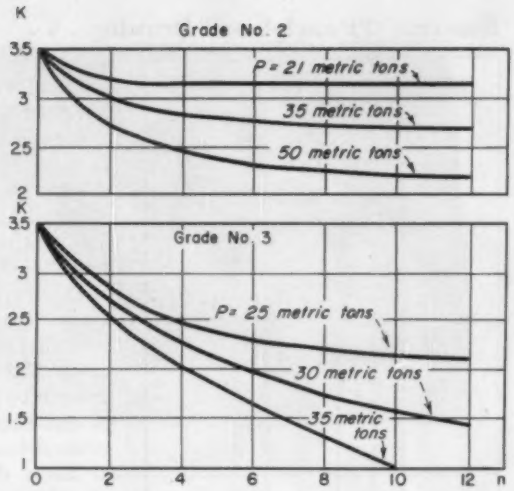


Fig. 5—Relationship of coefficient for deep drawing K and number of operations n, when $K_o = 3.5$ for rubber of Grades 2 and 3

ameter and of the same material, the number of operations decreases with the applied pressure. Depending on the degree of slip of the rubber along the blank surface, a definite deformation of the flange takes place. The flange diameter decreases most during the first operation and in later operations the metal movement slows down and stops as the metal work hardens. From test results the following empirical relationship was derived between the extrusion coefficient K of the drawn blank and the number of draws n:

$$K = K_o - bPn^m e^{\frac{c}{P}n} \qquad (2)$$

Where K_o = the initial extrusion coefficient

The author does not say clearly what he means by the "drawing coefficient, K" and the "initial drawing coefficient, K_o." It seems that K denotes the ratio of the length to which the component should be finally drawn and $K = 1$ is the finally desired drawing depth. As regards K_o, there is no explanation but it may refer to the ratio of the depth of drawing during the first drawing operation to the diameter of the drawn component. In the case of eq. (6), p84, it seems quite impossible to say what the author means by the value θ, the only reference to it, drawing "by trapping" (the quotes are in the original), does not explain it at all. In the equation

P = pressure in tons

b, c, m are constant coefficients characterizing the quality of the rubber. For instance, for a very hard rubber (Grade No. 3) $b = 0.0162$, $c = -1.645$, $m = 0.84$.

NUMBER OF DRAWS

This equation applies for $n<15$. When $n>15$ the equation gives values that are higher than the real ones. By means of a few transformations equation (2) can be put into a form suitable for determining the minimum number of draws to insure full drawing of the component to be manufactured. One use would be to increase the coefficient of extrusion from a given value of K_o to $K = 1$. Thus is obtained the following equation for the minimum number of passes:

$$n = -\frac{mt}{c}\,(3)\;P$$

where t is a variable which depends on the applied pressure, provided the same grade of rubber is used, or on the quality of the rubber if the press pressure remains the same. The value of the variable t can be determined from the following equation:

$$t = \frac{-(lnE-1) \pm \sqrt{(lnE-1)^2 - 4(lnE+2)}}{2} \qquad (4)$$

where

$$E = -\frac{(K_o-1)^{1/m}\,c}{(bP)^{1/m}\,mP}$$

It can be seen from equations (3) and (4) that the number of draws n depends not only on the magnitude of the applied force P but also on the properties of the rubber used in the process. Fig. 4 shows the curves $K = f(n)$ for very hard rubber (Grade No. 3) for a pressure of 35 tons (curve 1) and 30 tons (curve 2). Curve 1 of Fig. 4 corresponds to the value of equation (4), taking the expression under the square root as positive. Curve 2 corresponds to the same equation, if the expression under the square root in Fig. 4 is negative. Curve 1 intersects the horizontal $K = 1$, at $n = 10$. Consequently, the aluminum or aluminum-alloy blank in the given case will be finish-drawn in ten passes. The second curve does not intersect this horizontal at all. Therefore, this blank cannot be drawn satisfactorily with a pressure of 30 tons. The position of the curves depends on the quality of the rubber (for an equal pressure P of the press) or on press pressure (for an equal grade of rubber).

It can be seen from Fig. 5 that for medium-hardness rubber (Grade No. 2), the curves are located above the horizontal $K = 1$ and do not intersect this horizontal however high the press pressure is increased. These curves show that Grade No. 2 rubber is not suitable for deep drawing by this method. For very hard rubber (Grade No. 3) the curve intersects the horizontal $K = 1$ at relatively low press pressures, e.g. $P = 35$ tons. Consequently, it is possible to complete the deep drawing of blanks with

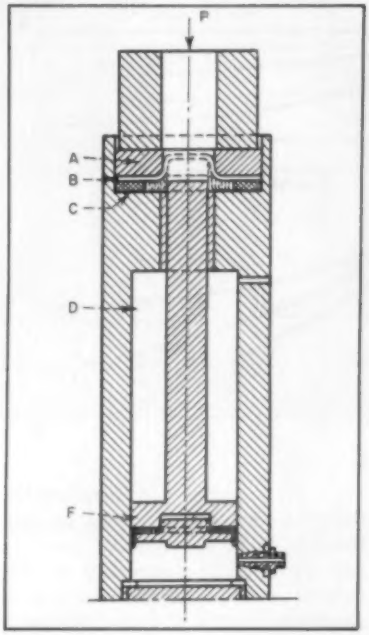


Fig. 6—By modifying the diameter of the rubber ring, a punch can also be used to achieve better quality of the work

such rubber. With increasing pressure the curve will fall more and more steeply before intersecting the horizontal $K = 1$.

The specific pressure q to be applied to the rubber is determined by means of the equation:

$$q = \frac{\theta s}{\mu r} \qquad (5)$$

where r = radius of drawing edge,
s = thickness of blank.

The total coefficient of friction μ is assumed as being 0.2 to 0.3.

The maximum value of θ can be determined by means of the equation:

$$\theta = 1.2\ a_b \frac{e^a}{a^a} (\ln k_o)^a \qquad (6)$$

where a is the real deformation of the metal at the instant of neck formation of a tensile-test specimen.

The correctness of the derived formula has been confirmed by calculation of examples and a large number of experiments in drawing aluminum and aluminum alloy by applying friction. Blanks of 40 to 105-mm dia by 0.5 to 1.5 mm thick were subjected to tests. The drawn components were of 15, 18, 20, 30 and 35 mm dia. Deep drawing applying friction forces was also tried on "St.1" steel (the composition of which is: 0.07-0.12% C, 0.35-0.50% Mn, 0.055% max S, 0.050% max P.)It was found that very high grade rubber is needed.

The upper limit of the coefficient of drawing K_o, is not limited by the mechanism of the drawing process but by the work hardening of the blank. If K_o (drawing during the first pass) is too high, considerable deformations occur which bring about work hardening and prevent further plastic deformation of the blank material which can cause material failures. Each metal has a different value for limit of deformation. Experiments have shown that the highest value of the initial coefficient of drawing of blanks which can be drawn in one operation varies in aluminum and aluminum alloy between 6.5 and 7.0.

The diameter of the finished component is determined by the physical properties of the elastic-friction element. Under shop conditions, the rubber ring cannot be loaded in excess of 6 to 7 kg.mm² if excessive wear is to be avoided. With a small radius on the component the required specific pressure on the rubber increases sharply.

The physical properties of the elastic-friction element influence the lower and upper limit of the ratio r/s. With increasing radius of the component r for a certain value of θ (which depends only on the value of K_o and the mechanical characteristics of the blank) the required specific pressure on the rubber decreases. Eventually, compression of the rubber may prove inadequate for movement of the rubber in the direction of the die hole. In such cases a large number of draws will be required. On the other hand, if the radius r is too large the rubber movement may be such that the press pressure must be increased excessively to get desired results.

WHEN A PUNCH HELPS

The shape and quality of the finished product will be satisfactory if the grade of rubber, the dimensions of the rubber ring and the press pressure are well chosen. Non-uniformity in the mechanical properties of ordinary commercial-grade rubber or local weakening of the rubber may be the reason for slight warping. Where metal thickness is below 0.5 mm, there may be a slight waviness on the surface. To prevent such defects it is necessary to apply an appropriate corrective draw (perhaps "ironing"?), or to introduce into the closed system the additional effect of a punch. Thereby, a higher quality is insured for components with and without flanges. Fig. 6 shows a cross-section of a closed drawing device incorporating a punch. Pressure of the press is transmitted through the die *A* and the blank *B* to the rubber ring *C* which, as a result of friction, forces the blank towards the hole of the die. Simultaneously, the punch *D* exerts a constant pressure P_n on the blank and also forces the metal into the hole of the drawing die. Air or oil under a constant pressure is fed under the piston *F*. The forces exerted by the punch on the blank must not be too large, to avoid cracking the flange of the blank.

SAME NUMBER OF DRAWS

Introduction of a punch into a drawing mechanism which is based on applying friction will not only improve the quality of the component but will also facilitate the work of the elastic-friction element. The grade of rubber, the thickness of the rubber ring, and the type of lubricant in this case will be the same as with drawing by friction alone, and the number of passes about the same.

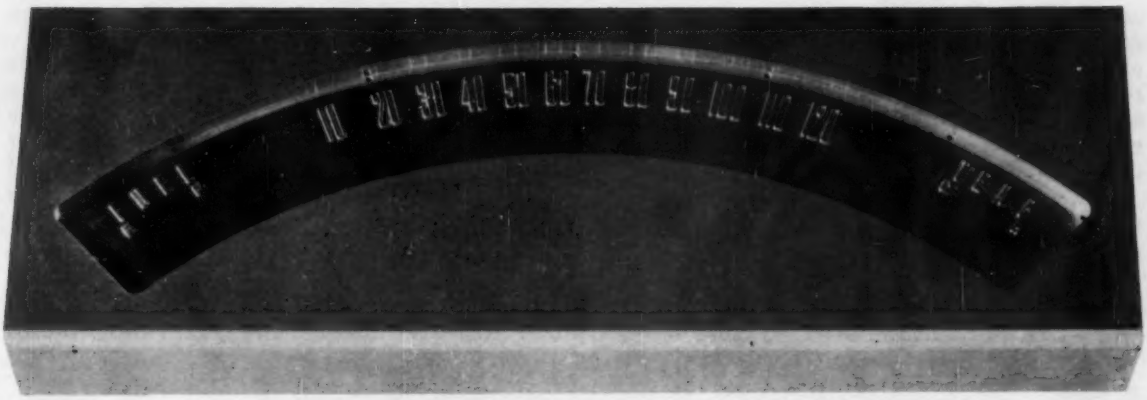
The rubber ring, applied when a punch is used, differs only in hole diameter. This diameter must be such that, even in its maximum deformation, the rubber is not supported by the punch. If the diameter of the rubber ring is larger than the established optimum diameter, waviness will be produced along the rounded edge of the die.

The formula for determining the hole diameter of the rubber ring for a "closed" system with a punch can be written:

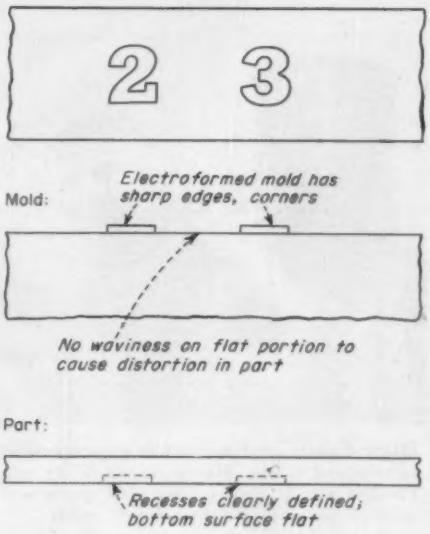
$$d_p = \sqrt{D_k^2\,\delta + d_n^2\,(1 - \delta)} \qquad (7)$$

where d_n is the punch diameter.

Clearance between the punch and die must be larger than in conventional drawing practice.



Mold with raised numerals . . . turns out plastic dials with recessed numerals. Mold could be machined, but final polishing around surfaces close to numerals would be a headache, at best. Electroplated mold was made by engraving numerals into flat brass plate, then electroplating against plate to produce the mold


2 3
Mold:
Electroformed mold has sharp edges, corners
No waviness on flat portion to cause distortion in part
Part:
Recesses clearly defined; bottom surface flat

Hard nickel plating makes molds ...and saves molds

CHARLES EMERSON, associate editor

Accurate built-up molds for plastic parts are made by silver-spraying a sample or master part, then plating on hard nickel, and finally plating on hard copper. The process is not expensive, but it is tricky; and it has several unusual advantages:

- **Molds with engraved designs on their *sides* can be made**
- **Moldmaking works either way—from a positive or negative model**
- **Difficult-to-machine molds can be made as easily as simple molds**
- **Deep hard-nickel plating will also neatly repair damaged molds, and will even form sample production parts**

Moldmaking with plated nickel bypasses the machining problems usually encountered when molds are cut from solid metal. After a mold is electroformed it is machined flat and square on the outside so it will fit in a die block, but that's about all the machining necessary. There are, however, some unique problems in electroplating that have direct effect on the quality of the mold produced.

Stress in the plate is one problem. It develops because of natural electrolytic action in the plating bath, usually when plating is done too rapidly. Sometimes even a thin plate of chrome will crack. If the bath is improperly controlled, stresses will build higher as the plate is formed.

Throwing power is a second problem. The natural tendency in a plating bath is for outside corners to build up heavily and for inside corners to take only a thin plate. But to produce a uniformly thick plate on an irregular surface, the bath must deposit metal in tiny recesses and behind projections. Bath control must include liquid circulation, electrolyte formula, temperature, and power.

Backup, the ability of the bath to keep building

Hard nickel plating makes molds . . . and saves molds . . .

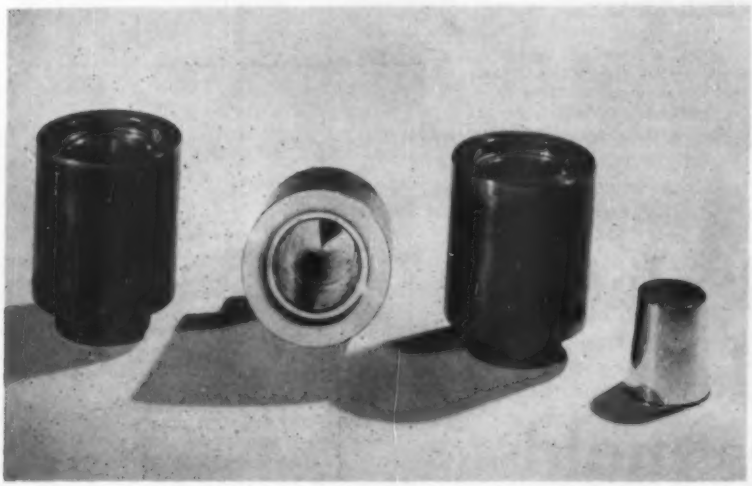
up plated metal evenly and accurately to required depth, may also be a problem. One common fault of plating baths is the development of "trees"—irregular formations that look something like sea coral. To prevent this effect, the bath must have good circulation of the fluid, correct bath formulation and temperature, and enough time.

These problems will be minimized if the bath is purified constantly and is controlled under what amount to laboratory conditions. Time is vital, too. A small hard-nickel mold may take as long as a week to produce. However, this does not necessarily limit production because duplicate patterns can be made and a number of molds can be formed at the same time.

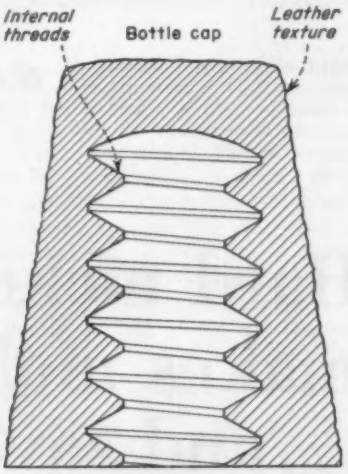
One great advantage of hard-nickel-plated molds is accuracy. The nickel is plated directly onto the surface of the pattern—not counting the thin silver spray—and the mold will match the dimensions of the original within tenths of thousandths. Nickel plating also reproduces the surface finish of the master, which might be matte or polished.

PRODUCTION PARTS

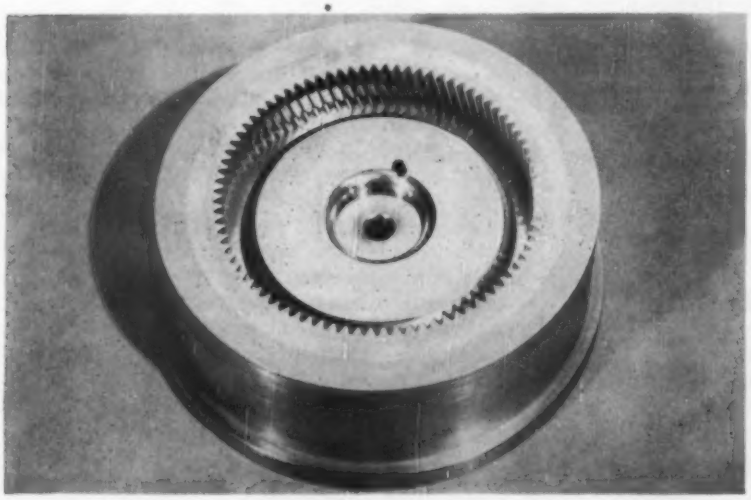
Some workpieces have been formed directly in electroplated metals; wave guides and fountain-pen



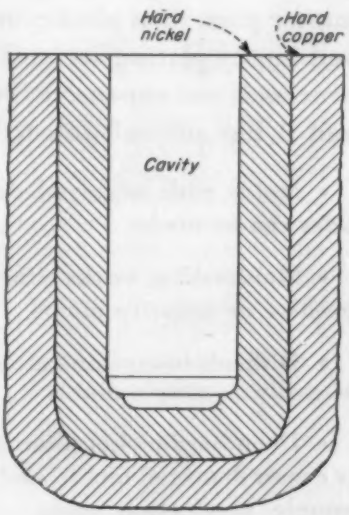
High finish and accurate reproduction . . . are characteristic of hard-nickel-plated molds. Master on which the mold was plated was a plastic sample. Finished part at right is from pilot production run, and illustrates how designs on sides of parts may be formed into molds



Severe undercuts in the mold . . . are possible as long as the molded product can be stripped out of the mold during production. Plastic will deflect enough to allow this. Depth of leather design on side is around 0.01 in. Machined mold could not economically approach the accuracy possible with electroplating



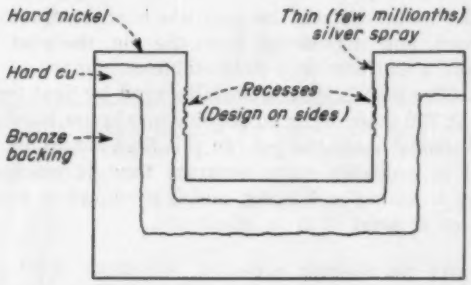
Deep cavities and complex internal shapes . . . can be machined, but plating is often easier, more accurate, and simpler. If master can be extracted easily, it can be made from metal. Fabricating a master for the deep mold (right) is simplicity itself, but machining the mold might be difficult. Gear mold was plated because tooth ends could thus be formed flush with bottom diameter



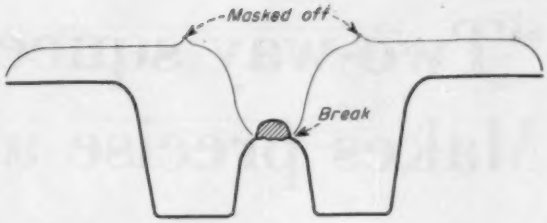
caps are two examples. The process is relatively expensive, but some special jobs can be handled no other convenient way.

Repair work is another area where hard-nickel electroplating may provide simple solutions to difficult problems. For molds that do not require high strength, such as for plastics molding, a broken mold section can be replaced with plated metal, which is then machined down to shape.

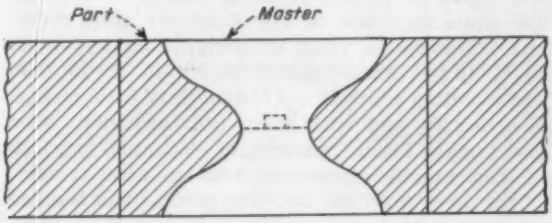
Electroplating molds, as well as production parts, is a refinement of existing theory and practice, coupled with special plating-bath techniques. It is called "Nicoform" by Electromold Corp, Trenton, NJ.



Mold is built up . . . from thin (in the millionths) silver-sprayed layer on master. Nickel is generally about 3/16 in. thick, and copper may be 1 in. thick or more, depending on size and cost factors. Finally, copper jacket is machined to fit die ring or some suitable mounting arrangement for the press



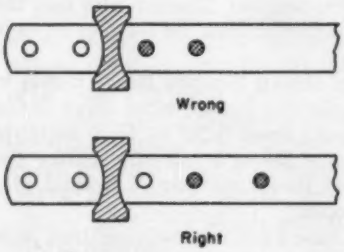
Mold repair is extension . . . of mold-forming process. If central ridge has broken off, all other areas are masked with special materials, leaving broken area exposed. Plated-on ridge can be built up to any reasonable height, then machined down to required contour. Plating may take a week or two, but final structure will be solid enough for molding plastics



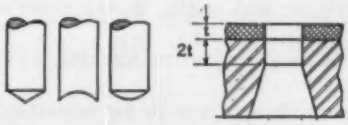
Production parts can be made . . . by electroplating to high accuracy and near-perfect finish. This nozzle was made by turning neck in metal master—it was split and threaded to allow disassembly to clear the mold. Part was built up completely in electroplating bath, after which outside was machined

Diemakers Kinks

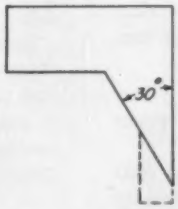
FEDERICO STRASSER



IF PIERCING holes in cut-off dies fall too close to the parting edges, locate the piercing holes a whole station in advance.

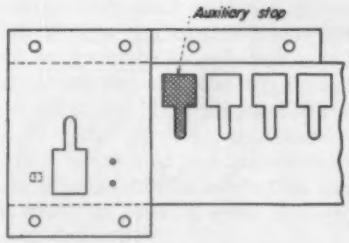


PIERCED SLUGS can be restrained from coming up out of the die hole by several means, including: (1) decreasing punch clearance to half the value for blanking, (2) applying a special form to the punch end—shallow point, concaved, or rounded, and (3) making the die opening straight for twice the stock thickness.

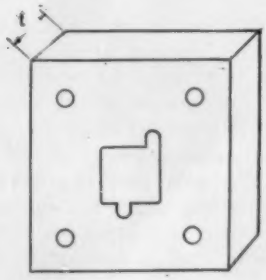


AVOID BLANKS with a sharp edge or corner, or at least making them in one operation. Punch life will be shortened and an unsatisfactory part will be produced. If a sharp corner must be produced, blank the part according to the dotted outline and then cut it off in a second operation.

HOLES in a die plate must be located at a distance from the die opening at least equal to the plate thickness, in order to avoid formation of cracks during hardening.



AN AUXILIARY STOP should be fastened to the stock gage and support when reverse blanking, or passing a double-width strip through the die for the second time. This stop should almost exactly follow the contour of the blank opening.



"Two-way squeeze" Makes precise aircraft members

Compression forming restrikes rubber-formed channels and curved, flanged bulkheads in such a way that the flange angle and the moldline width can be held to tolerances demanded for supersonic aircraft and missiles

In a sense, compression forming achieves the same end result as stretch forming, except in reverse. The grain structure of the aluminum alloy material is forced to yield in compression by ½ to 1½% to set flange angles to within ± 45 min. and moldline width to ± 0.010 in. Very little springback occurs, and what there is is consistent from part to part. Elastic recovery, or elongation in width of web, usually amounts to 0.007 in. after removal of the piece from the die. The process was worked out by F C Hoffman, manufacturing research engineer, and F C Schroeder, mathematical specialist, at Lockheed Aircraft Corp, Burbank, Calif. A patent application has been made on the process.

A conventional rubber-forming press or a mechanical press with a double action can be used for compression forming. The process involves two applications of pressure: (1) application of about 100 psi to a rubber form pad inside the part to make the metal spread out and fit the die interior, and (2) application of compressive force endwise to the flanges, in order to set the metal. Total pressure applied should be in the order of 1000 psi over the rubber-forming press table. If the above pressure requirement can be met, as many setups and pieces can be formed simultaneously on a rubber-forming press as there is room for them on the press platen.

DETAILS OF PROCESS

Compression-formed parts are made by two press setups. Steps are:

1. The sheet-metal part, such as a U-shaped spar or a flanged curved bulkhead, is first formed to broad tolerances by conventional rubber-forming procedure, using about 1000 psi.

2. Joggles in the rubber-formed part are defined and waves in flanges are removed by handwork if too severe. Then the part is shaper sawed to establish a uniform flange width.

3. The preformed part is now heat-treated (925 F for 30 min. in the case of 75ST or high-strength 7075T6 aluminum alloy) and then water quenched. Now for a period of 20 min to one hour, the metal is malleable and is ready for compression forming.

4. The soft part is placed in the compression forming die, which has contours made to the *outer* dimensions of the master part. This feature of the die eliminates compensation for thickness variation of the metal. When the part has been compression formed, and is removed from the die, the part recovers a uniform and predictable amount.

5. The part is now artificially aged by heat treating at 250 F for 24 hr to acquire maximum hardness and strength—72,000 psi. In this final condition, the part is probably more accurate than if machined from a casting or forging, and is produced at a saving of at least 50% in manhours.

DETAILS OF MAKING DIE

After compression forming, the flange angle springs in from B, the die angle, to B_1, the part angle, Fig. 1. This effect is taken into account in making the die.

Before making the die, an undersize master pattern is required. To produce the master, a templet is made to the outside moldline of the part. Recast aluminum plate is rough sawn oversize to the templet outline, and the two pieces are fastened together. To finish the master, an angle-contouring machine is employed. This tracer-type machine has a cutter head that can be tilted to the flange angles desired (approximately 1° spring-in). The tool also cuts the master 0.0035 in. narrower than the templet on each side.

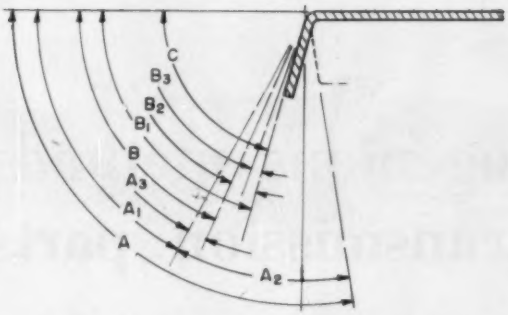
Experiments had shown that the flange moves in about 1 deg. from the die surface after compression and the web increases about 0.007 in. from moldline to moldline. To make use of a *full-size* master (no springback or mold line correction) a special procedure was developed:

1. The steel-die base has a channel machined wide enough to receive inserts and is deep enough to accommodate a stripper.

2. Aluminum angles are placed inside the die opening and about ⅜ in. from the master model. The angle sections are tipped inward 1° by means of a shim. Moldline width is increased by a shim placed between stripper and angle. Epoxy resin is poured, as shown in Fig. 2.

Spring-in of 1° is necessary when working 0.081 in. 75S to 1 t radius.

3. When the epoxy inserts are to be assembled to the die, the shims are removed. Thus, the inserts rotate outward 1° and move 0.007 in. inward. Epoxy is now poured to fill the space between the aluminum angles and the die walls.



SYMBOLS

RUBBER-PRESS-PREFORM		COMPRESSION FORMING	
A	Block angle	B	Die angle
A_1	Part angle	B_1	Part angle
A_2	Springback	B_2	Spring-in
A_3	Preform interference	B_3	Tolerance to engineering loft
C	Engineering loft		

FIG. 1—Aluminum channels are over-formed on a Masonite block, spring back to A_2. When compression formed to die angle B, the ejected part closes in to angle B_2

4. End dams are added to contain rubber pad pressure.

5. A stripper plate is essential because the work will stick tightly at the bottom of the die in the radius tangency area. The stripper plate rests on rubber cushions 1 in. dia by ¾ in. high and placed in 1¼-in. holes counterbored in the die base.

6. The pressure-pad assembly consists of three parts: (a) a metal plate that lies in the bottom of the preform to prevent distortion of the web up to the area of tangency, (b) a rubber pad of 40-60 shore hardness, and (c) a lower pressure pad acted upon by pressure pins supporting the upper pressure pad.

When the rubber platen applies pressure to the upper pressure pad, the rubber die insert forces the flanges tightly against the die walls. A rubber force of at least 100 psi is needed to prevent the flanges from buckling under compression loads. Width of the upper pressure pad is made about ¾ width of lower pressure pad. Height of the upper pressure pad is adjusted to obtain desired pressure in the rubber before the punch assembly applies pressure on the flanges.

7. Normally, the punch assembly consists of two CR blades attached to an aluminum spacer. A multiplier plate on top is not attached to the blade assembly to avoid springing the latter out of shape if any bending is caused by rubber pressure. Multiplier plate width is developed to obtain compression force of 27,000 psi in the flanges, or 20% above the yield point of 75S-T in the fresh W condition.

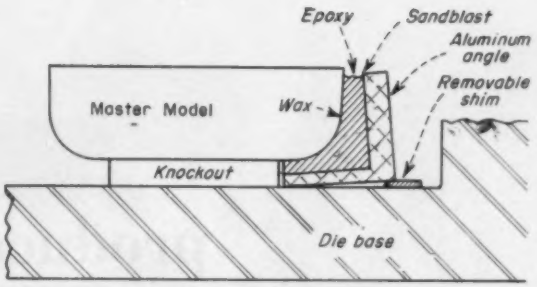


FIG. 2—Form-die radius and flange-angle surface are made by pouring epoxy resin between master and shimmed angle

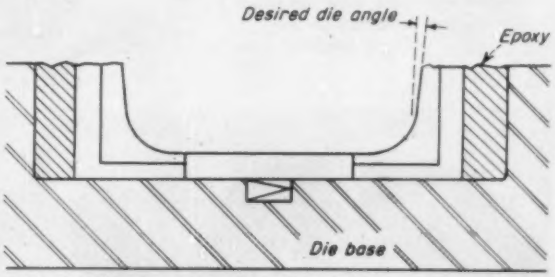


FIG. 3—Shims are removed to throw inserts at proper die angle, and spaces between angles and die base are filled with resin

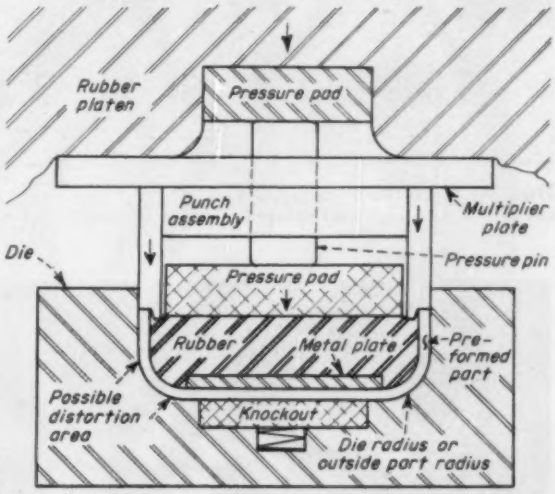


FIG. 4—Timing of the die is such that in excess of 500 psi is built up within the rubber die insert before the punch blades apply compressive force to the flanges

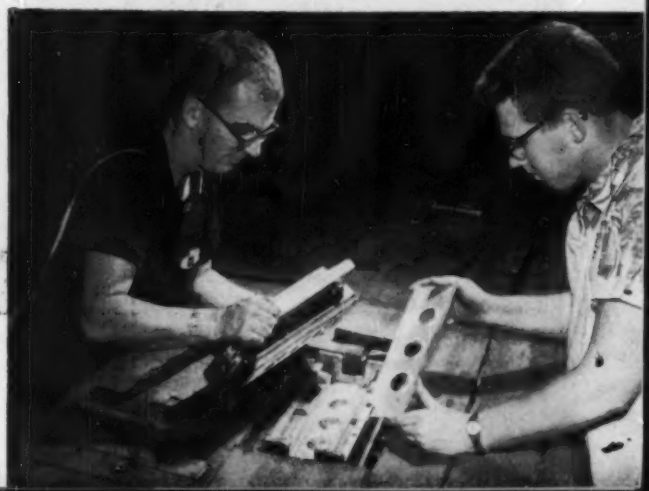
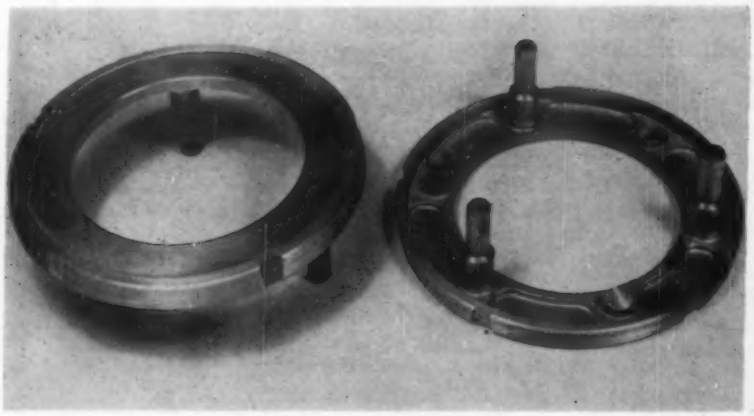


FIG. 5—Flanges are straightened and lightening holes are embossed in this case, but channels up to 90 in. long are likewise trued by compression forming

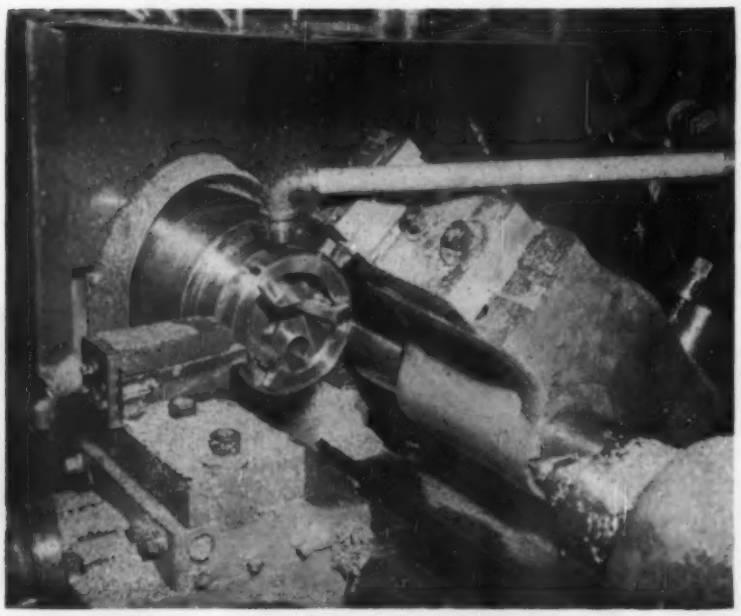
Ingenious methods produce transmission parts

With a brand new transmission to work on, process engineers cut loose with some interesting cost-saving methods

DAVID R OSBORNE,
chief industrial engineer
SYRACUSE, N Y
NEW PROCESS GEAR CORP



Die-cast aluminum ring . . .
has cast-in, hardened blocking pins, threaded OD on tapered friction surface

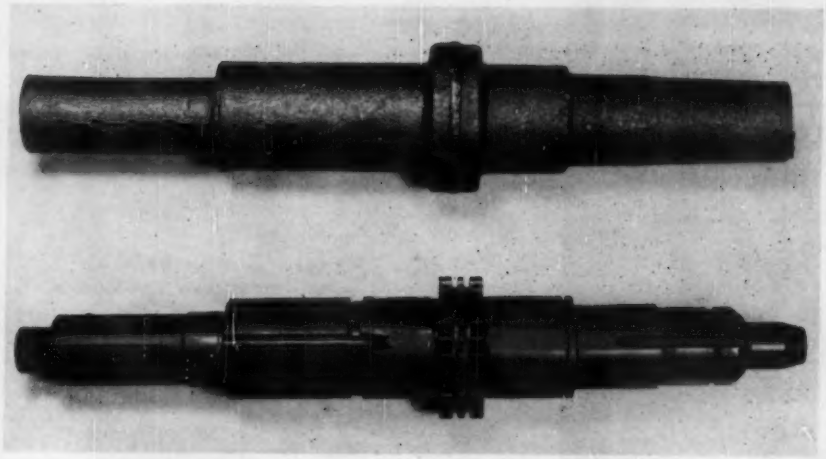


Facing, turning . . .
chamfering, and threading are performed at one chucking on Fay automatic

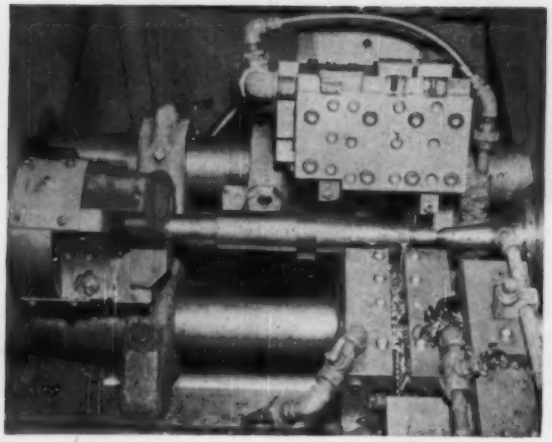
One of the critical parts in the design of our new Model 540 truck transmission is an aluminum friction ring which serves to synchronize its mating gear for quick, noiseless meshing when changing gear ratios. The first design called for three steel pins to be riveted into drilled roles in the ring. In the improved production model, prehardened steel pins are cast directly into the ring.

After casting, the ring is faced on the front and rear faces, and the OD turned to a 7° angle on a Fay automatic, the work being held by three fingers actuated by a pull-back air chuck. In the same setup, the OD is threaded with a fine-pitch thread. At the next operation, three pads located between the pins are spotfaced on a multiple-head drillpress equipped with a four-position indexing fixture. Final operation consists of honing the threaded surface with a hollow stone to remove all burrs and sharp edges. Stones are specially made to suit the 7° angle and will produce about 25 pieces per dressing.

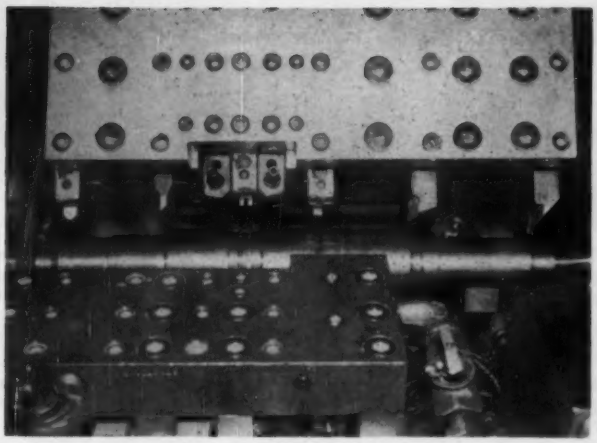
Another critical part is the forged medium-carbon alloy steel mainshaft which is turned from both ends, gear teeth cut and shaved, splines cut and ground, and bearing diameters ground. The part is then Lubrized to insure adequate lubrication during the break-in period.



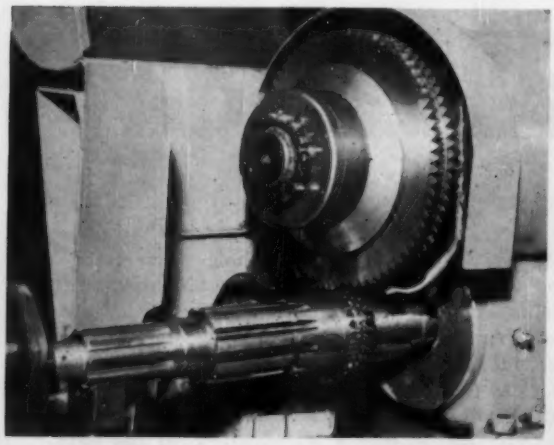
Mainshaft . . .
for Model 540 truck transmission is machined from alloy-steel forging, carburized, hardened, and ground, then Lubrized



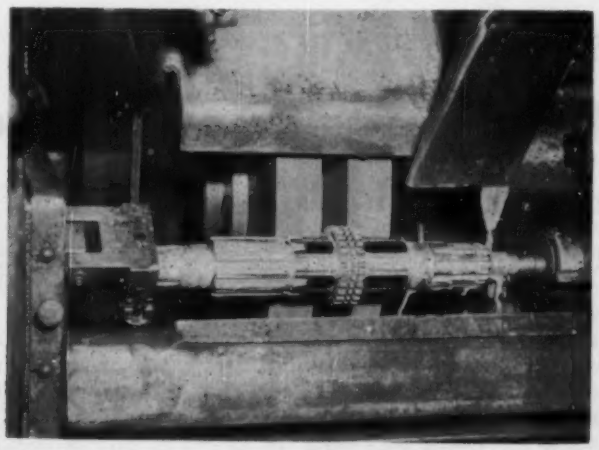
Both ends . . .
of mainshaft are rough turned in two operations on Fay automatics, using a master to produce the required profiles



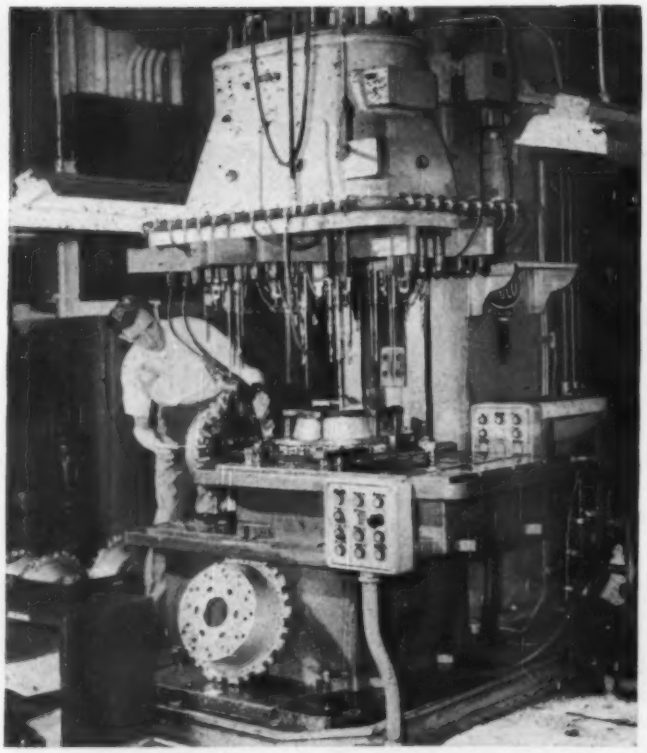
Finish turning . . .
is done on a Fay automatic and includes facing and grooving operations in multi-tool setup



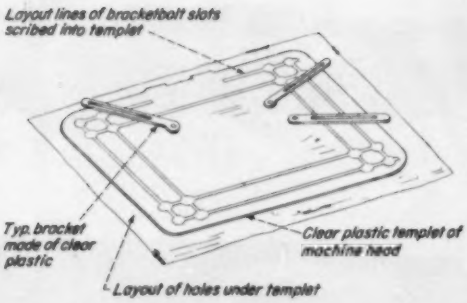
After spline . . .
and gear hobbing, sliding clutch teeth are shaved on a Fellows shaver, using a spaced cutter to leave center teeth untouched



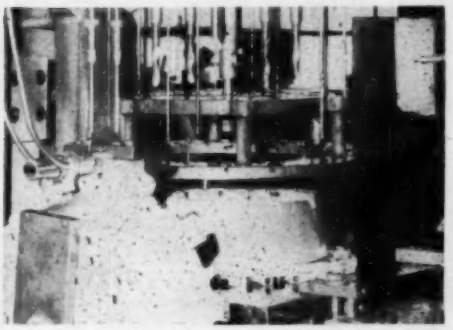
Oil-passage . . .
reliefs are ground on Norton Cam-O-Matic grinder and are indexed to line up with adjoining splines



Trial setup with old jigs, to determine whether new jigs are required, is first step in job procedure. First setup consists of 9 spindles to rough drill two 7/16-in.-dia holes and one ¼-in.-dia hole in each of three parts. Part is indexed 12 times for 108 holes. Next, 20 spindles finish bore and ream two 7/16-in.-dia holes and two ¼-in.-dia holes, indexing 12 times. Vertical jig is used to drill 14 holes varying in size from No. 21 to ⅝-in.-dia, indexing 6 times for 110 holes. For the third operation, 12 spindles tap twelve No. 10-32 threads and twelve ⅝-16 threads, all 24 holes in two indexes. Spring and friction tap holders allow simultaneous tapping with different sizes of taps


Layout lines of bracketbolt slots scribed into templet
Typ. bracket made of clear plastic
Clear plastic templet of machine head
Layout of holes under templet

Plastic templets of the spindle brackets and the machine head are kept in Tool Design for use in spindle layouts and indexing selections of holes to be drilled. Using this type of templet saves considerable layout time in the shop and minimizes the danger of error



Large jigs, too heavy or awkward for a man to lift, are raised by the machine's power after the last index of the third setup

SHORT RUNS PRACTICAL:

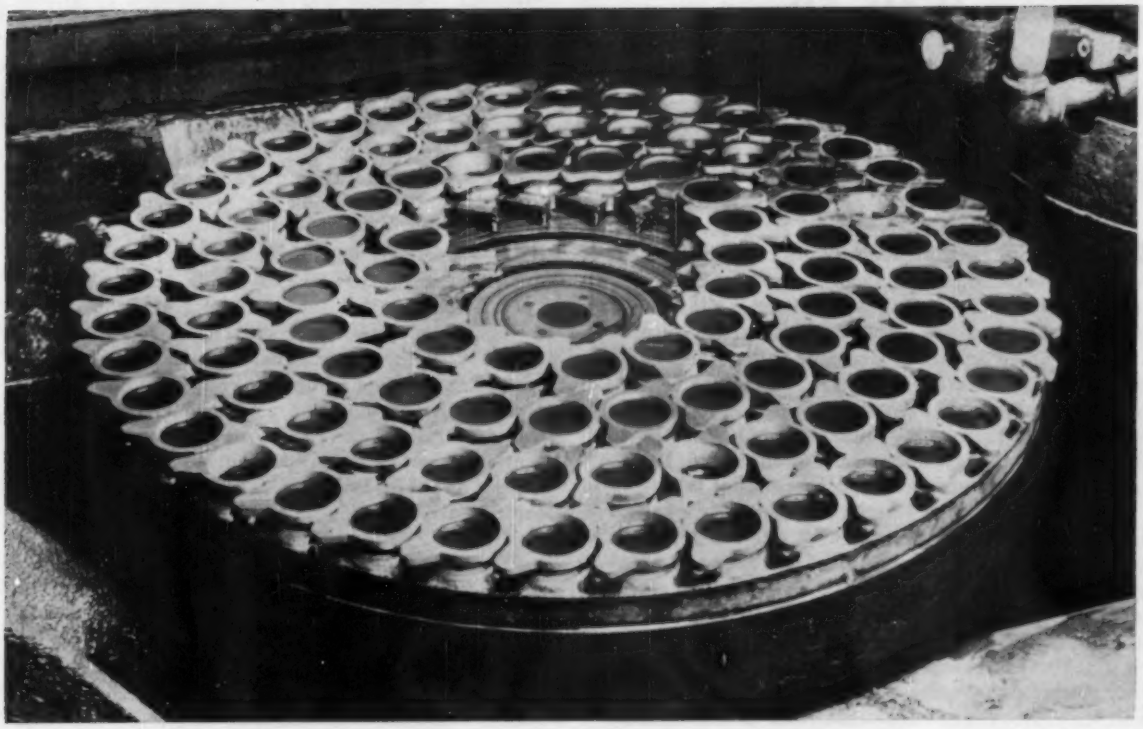
Flexible tooling cuts multi-spindle drill time 70%

ERIC SAMUELSON, Brooklyn Plant, AMERICAN MACHINE & FOUNDRY COMPANY, NEW YORK

Uniform parts, increased production, and a new low in rejection rates are among the benefits we have gained as a result of improving the tooling on a 15-hp, 24-spindle, semi-automatic drillpress. Because its flexibility, including a variety of spindle speeds and feeds, minimizes setup time, the machine has proved practical for production lots as small as 50 to 100 pieces.

A cast-aluminum turret, used on an AMF cigarette-packaging machine, for example, contains 110 different holes which are drilled, bored, reamed, and tapped in only 30% of the time formerly required with three-spindle drillpress operations.

Each spindle on the machine is easily set up and aligned. A rough layout is prepared by the tool designer and sent to the shop, where each drill or boring bar is aligned with each bushing in the drill jig and tightened in position. Next, travel is adjusted and locked into a Microswitch. If the part to be drilled has a deep hole, provision is made for chip removal. For cleaning, unloading, and reloading, the machine can lift large jigs off the part.



Surface grinding . . . cast hose couplings. Production rate averages 200 per hour, with 102 couplings finished at a time from the as-cast condition

Grinding of iron castings serves both to provide a fine finish on a machined surface and as a way to finish directly from the cast surface. Honing and lapping serve where finer finishes are required.

HOW TO ABRASIVE FINISH CAST IRON

CHARLES F WALTON, technical director,
GRAY IRON FOUNDERS' SOCIETY, INC. CLEVELAND

This summary of abrasive finishing methods was prepared for inclusion in the forthcoming "Gray Iron Handbook" to be published by the Gray Iron Founders' Society. It complements the machining section of this handbook published in a recent issue (AM — May 20 '57, p137)

HOW TO ABRASIVE FINISH CAST IRON

Grinding as a finishing operation, after machining, has long been an economical method of obtaining accuracy and a fine finish. Recent developments have greatly increased the number of practical applications for finish grinding. Grinding is now also common as a finishing operation for castings to replace machining. This has been made practical by the development of improved grinding wheels, more powerful grinding machines, and the availability of castings with close dimensional tolerances.

Although the direct finishing of castings by grinding has a number of limitations, it offers several advantages where it is applicable. The allowance for grinding can be as little as will clean up and result in the desired dimensions, in contrast to the stock allowance for machining, which should be sufficient so that the tool consistently cuts below the cast surface. Internal stresses usually involve surface metal, and its removal can cause distortion of the casting. Where distortion is critical, its correction may eliminate any advantage in grinding, and correction may not be possible with a minimum finish allowance. Interrupted surfaces, such as those containing slots or ports, offer no disadvantage to grinding, and in fact, are advantageous in tending to reduce the grinding power requirements (for the same volume of metal removed).

Where castings are hardened for wear resistance by conventional heat treatment or are surface hardened by flame or induction, they can be finished by grinding. A typical example is the precision grinding of hardened machine tool ways. White iron or the high-alloy irons which are too hard to be economically machined may also be finished by grinding.

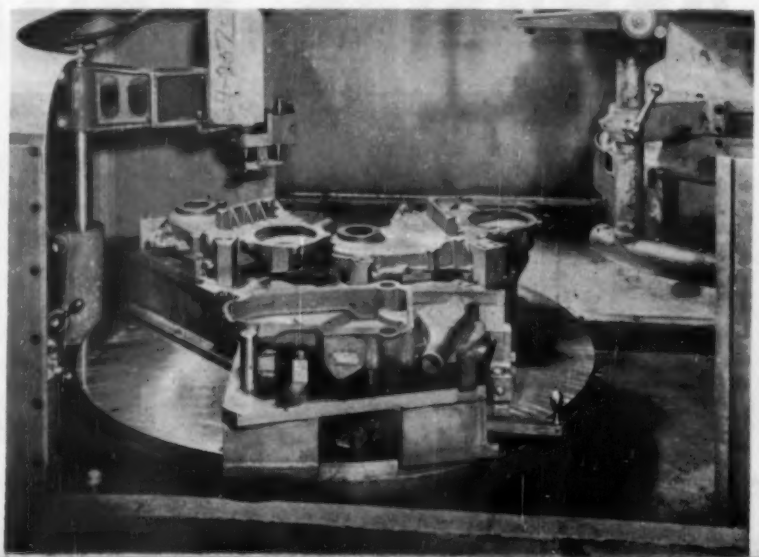
Thus, there are three basic reasons for the use of grinding to finish iron castings:

1. To obtain surface finish or accuracy not readily obtainable by machining.
2. To replace machining as a finish operation where grinding is more economical.
3. To finish the types of irons which are too hard to be machined.

The success of any machine operation depends upon having the proper set-up. In machining, the type of iron being cut has a definite influence in selecting the most suitable cutting rate. Differences in microstructure or hardness do not have a major influence on the grinding rate, but are important in selecting the grade of abrasive wheel that is most suitable for the job. Irons with a pearlitic or heat-treat-hardened matrix and containing fine flake or nodular graphite will have a better appearing surface when finely ground, but even a fully annealed iron casting is not soft enough to smear the face of a grinding wheel. The surface of the casting, however, can be flowed or strained by use of an improper grade of wheel.

The abrasive for grinding iron castings may be either silicon carbide or aluminum oxide. The selection for best results depends upon economical as well as technical considerations. The wheel selection as to abrasive, grit size, grade, structure number, and bond will depend upon the type of grinding operation to be performed and the finish requirements of the job. The speed at which a grinding wheel operates is very important. Vitrified-bond wheels are used at speeds up to 6500 sfpm. Resinoid-bond wheels may be run up to 9500 sfpm. An excessively high speed, besides being unsafe, increases the apparent hardness of the wheel and may burn the work. Lower than recommended speeds may result in rapid wheel wear.

The recommendations following are for general consideration. Each job, especially in production grinding, may have a sufficient number of particular



Three fixtures on the rotating table . . . of this machine are designed so that three castings are ground simultaneously on different surfaces. Castings are placed in each fixture progressively and one casting is completed per operation

characteristics to require individual consideration before the best method of grinding and grinding wheel can be selected. All of the reputable abrasive and equipment manufacturers have experts on grinding whose services are available.

TYPES OF FINISH GRINDING

The size and shape of the casting, as well as the geometry and finish of the desired surface primarily determine the type of grinding operation that can be used. The common methods of finish grinding can be classified under six headings: surface, cylindrical, centerless, internal, honing and lapping. The many kinds of grinding machines also differ in size, power, and type of fixture to hold the work.

SURFACE GRINDING

"Surface grinding" designates the grinding of flat surfaces, although some of the machines for this purpose can also be used to grind certain other forms. Surface grinders may be considered in three basic types, depending upon the orientation of the grinding wheel and its working face.

Vertical-spindle grinders—The abrasive wheel in this type of machine rotates on the bottom end on a vertical shaft and grinds on its flat face as the work passes under it. This type of grinder is capable of very high rates of metal removal. As a typical example, a 24-grit 18 x 5 x 15 in. wheel could remove 5 cu in. per minute from a 500 sq in. surface.

Because of the broad area of contact between the wheel and the work, the selection of the proper type of grinding wheel is particularly important. The wheel may be of a cup, cylinder, or segmental type, but generally has a vitrified bond. Either silicon carbide or aluminum oxide abrasive may be used, the latter being preferred for the harder grades of iron. The grit size will depend upon the finish requirements; the finer grits provide a finer finish, but the coarser grits remove stock faster and more efficiently. A No. 24 grit will produce a finish of approximately 50 microinches rms, while an 80-grit wheel can finish to 15 mu in. rms. Hardness grades of G to J are commonly used with the softer grades for the larger work areas.

Horizontal-spindle grinders—This type of machine is popular because of its versatility in both plain and form grinding. The abrasive wheel rotates on a horizontal spindle, and normally grinds with its peripheral surface. The work table may be of either rotating or reciprocating type. Vitrified bonded wheels are normally used in diameters from 6 to 20 inches. Either silicon carbide or aluminum oxide abrasive is used in a grit size usually within a 36 to 60 range. The coarser grit gives a faster cut, while the finer grit produces a better finish and holds form more accurately.

In a typical grade range of H to K, the softer grades are better for fast stock removal, the harder grades for holding form or corners. In a typical application, a 36-grit wheel removed one cubic inch of metal per minute and gave a 50 mu in. rms finish.

Disk grinders—The horizontal disk grinder has long been popular for finishing castings. It is particularly applicable where a flat surface is required without exact dimensional relation to other surfaces. A typical use is for grind finishing of cover plates. Furnace doors and frames are ground to a "cigarette paper fit" on disk grinders. A set-up is not necessary for this machine, since the castings are held against the disk by hand, but care is necessary to obtain an even cut and to avoid overheating. Resinoid-bonded silicon-carbide abrasive is normally used, but the grit may vary over a wide range (16 to 220) depending upon the finish requirement. A grade range of L to P may be considered normal, the selection depending upon the size of the work and the amount of stock. Most grinders of this type are equipped with an attached dresser, so that a flat surface can be maintained on the abrasive disk. There are several other varieties of disk grinders, such as a vertical, twin-disk type which can surface two parallel sides of a casting simultaneously.

Cylindrical grinding — A machine which supports and rotates the work on centers is called a cylindrical grinder. These vary in size from small

Finishing the face . . . of a gray-iron housing on a horizontal disk grinder. Parts are checked on the surface plate behind the operator to determine when it is necessary to dress the wheel

HOW TO ABRASIVE FINISH CAST IRON

toolroom machines to the very large units which are used to finish rolling mill rolls. The abrasive wheels for cylindrical grinding are of vitrified or resinoid bonded silicon carbide. For roughing, the grit size is usually between 24 and 36 in an M to Q grade. The grit size for finishing depends upon the finish requirements, but the most desirable wheel grade will vary with the size of the work, since this influences the contact area between the wheel and the work. Harder wheels can be used on smaller work. The following is a typical (though not invariable) relation.

Finish— microinches rms	20	15	10	5	3
Grit size	46	80	120	220	400
Grade range	K to N	L to P	L to P	L to P	N to P

CENTERLESS GRINDING

In this method round work is supported on a work blade between an abrasive feed wheel and the abrasive grinding wheel. It is the fastest production method for finishing cylindrical shapes. A "through feed" is used when only one (the maximum) diameter is being ground; otherwise, a "plunge feed" is used. Abrasive wheels of silicon carbide with a vitrified bond are normal. The most desirable grit size and bond vary widely, depending upon the type and size of work and the finish requirements. The following data may be useful as a guide:

Finish— microinches rms	20	15	10	5
Grit size	36	60	80	120
Grade range	K to N	L to P	L to P	L to P

INTERNAL GRINDING

As implied, this is a method for grind finishing the inside surface of holes. Aluminum-oxide abrasive is generally preferred, although silicon carbide is also used. The proper selection of wheel grade will depend upon the relative difference in diameter between the hole and the wheel, as well as the other factors of work and finish requirements. With a grit size of 36 to 60, the preferable grade may be between K and N.

HONING

Honing is a low velocity abrading process that can remove stock rapidly and generate a surface to accurate geometry, size and fine surface finish. It can be as productive as conventional grinding and as accurate as lapping, but is quite different from either. Honing can be used to finish both internal and external cylindrical surfaces and on all types of flat surfaces.

The honing tool for internal cylindrical surfaces has a number of abrasive sticks mounted around the periphery of the body. As the tool is rotated and reciprocated through the bore, the abrasives are forced out radially by a positive wedging action. The force is equal in all directions, on the full cutting faces of the sticks. Either the tool or the workpiece floats, so they automatcially align themselves, generating a true cylinder along the neutral axis of the bore. Cylindrical surfaces from ⅛ to 40 in. in diameter are being honed. The length of the cylinder that may be honed is limited only by the stroke of the machine used, of which there are many standard and special types. Cylinders 40 feet long are being honed, when as much as 0.100 in. is removed from the diameter.

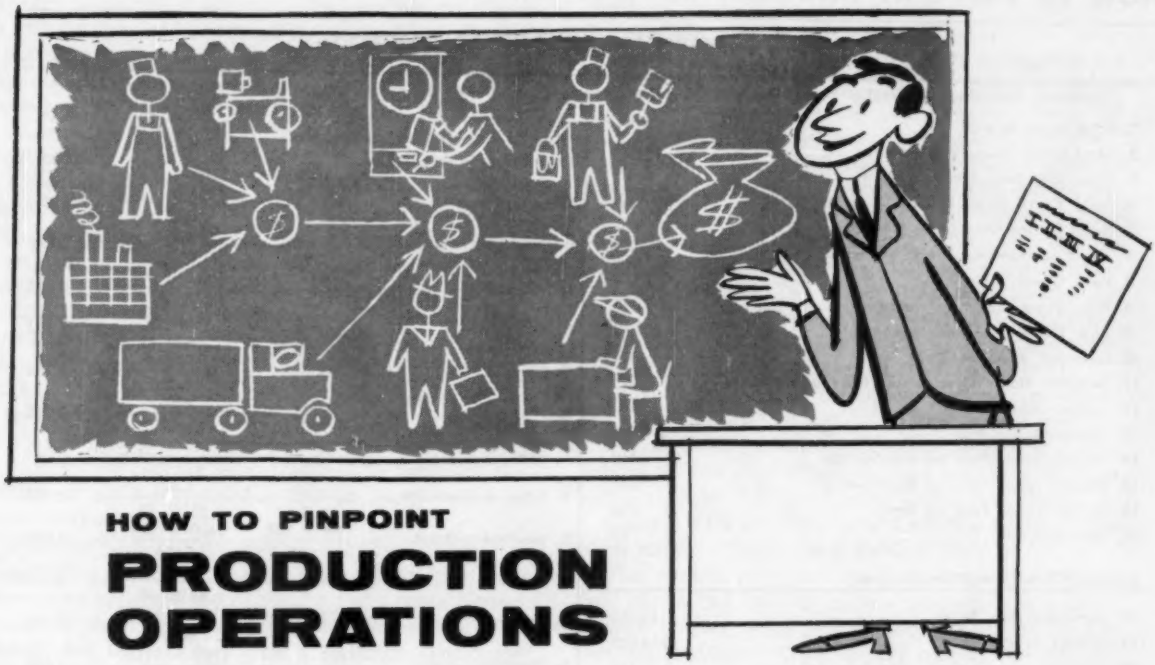
The abrasive sticks are selected so as to be self-dressing. The correct combination of motions and pressure causes the abrasive grain to fracture and form new cutting edges at the proper rate. The large area of contact between the surface and the abrasive, and the relatively low speed avoid localized heating. The rotational speed used in honing cast iron may vary from 100 sfpm for the harder types up to 250 sfpm for the soft grades of iron. Reciprocation speeds vary between 50 to 75 fpm.

The coolant commonly used in honing cast iron is kerosene mixed with lard oil in proportions of 9 to 1 for the higher speeds, and 6 to 4 for the lower speeds. The abrasive sticks are of silicon carbide for honing iron castings. The grit size is usually between 100 and 400 with a bond grade of L to P.

Although finishes with a roughness of only a few microinches rms can be produced by honing, there are many engineering applications where waviness of the surface and the lay (the direction of the predominant surface pattern) are equally important. Good honing can produce surfaces that are extremely flat or true cylinders. The typical cross-hatch pattern is considered very desirable for retaining lubrication. Automobile engine cylinders are honed to a controlled roughness to promote a rapid "wearing-in" and a tight seal. Specifications for roughness vary between 18 and 35 mu in. rms. Some makes of refrigeration compressor cylinder bores and pistons are honed and selectively fitted to a 0.0001 in. tolerance; so that a gas seal is effected.

LAPPING

Lapping is an abrading process for refining the finish and accuracy of a surface, rather than a method of stock removal, since size is seldom changed by more than a few ten-thousandths of an inch. This process is characterized by the use of a loose abrasive (frequently suspended in oil or water) between the work and a lap. The lap may be of lead, copper, gray iron or cloth. The term is also used to include finishing with a very fine abrasive paper or bonded abrasive. Iron castings are not commonly finished by lapping, but gray iron is very often used for lapping plates to finish other materials.



HOW TO PINPOINT

PRODUCTION OPERATIONS

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For effective plant economy, production standards should be established, and the various segments of production should be integrated. In the previous article (*AM*—May 20 '57, p153) of this series on small-plant management, 16 control ratios were developed from production statistics. This article further refines these basic controls into 8 composite controls that can show the busy executive the state of his production health at a glance, and includes a case history that applies the controls

The most elementary type of factory control is that which sets out absolute facts (unrelated data) from production. This statement of expenses incurred and hours worked—obtained by an analysis of time and production reports and payroll journals —does not set up targets for remedial action.

For management to take action because, say, total paid direct labor changed during successive periods is shallow. A higher direct-labor percentage for the second period might mean only that more people were on the payroll to support higher production, or that less indirect labor was expended for the same gross payroll. Only when that higher expense is related to other production statistics can the rise be considered evidence of economic movement.

The relationship between various unrelated or primary data in over-all production is shown in Table I, in the form of ratios that evaluate one segment of production by comparing it with another that affects it. Here valid and objective economic fluctuations can be seen by comparing a ratio for one week with the same ratio during following weeks.

This family of ratios is valuable for pinpointing profit leaks and functions effectively for plant managers and general foremen. These ratios are somewhat cumbersome to the busy executive, who should have the convenience of briefer, more inclusive controls. He may consult these secondary ratios later, of course, for causes of basic production fluctuations.

General management is not really interested in the isolated improvement or regression of one of the cost facets of production. That's the job of the plant manager. General management is interested in the over-all progress of the production picture. If certain facets of production are slipping, however, the controls furnish the boss with information for constructive counselling with his plant manager.

TERTIARY CONTROLS

On the management level above factory operations, there are areas of control other than production that must also receive attention. Therefore information from production must be condensed, reliable, and to the point. This information is produced by compounding new ratios from the secondary ones in Table I. These composite or inter-related ratios are shown in Table II.

These tertiary ratios, together with all other ratios thus far mentioned, depend on accurate time and production reporting from the shop and a factual payroll analysis. *The ratios are only as accurate as the production data.*

Besides giving the facts of production economy, these composite ratios change the nature of the re-

TABLE I: PRIMARY AND SECONDARY CONTROLS

Unrelated Data from a Weekly Payroll-Analysis Summary

1.	Total Gross Payroll	$ 8181.40
2.	Total Gross Hours Worked	4400
3.	Total Overtime Premium Paid	$ 358
4.	Total Hours Direct Labor	3800
5.	Hours on Incentive Direct Labor	1800
6.	Hours on Non-Incentive Direct Labor	2000
7.	Paid Direct Labor	$ 6430
8.	Pay, Direct Labor on Incentive	$ 2860
9.	Pay, Direct Labor on Non-Incentive	$ 3570
10.	Incentive Premium Paid	$ 433.40
11.	Incentive Hours Over Clock Hours on Incentive	278
12.	Indirect-Labor Hours	600
13.	Indirect Labor Paid	$ 960
14.	Indirect Labor Paid for Maintenance	$ 460
15.	Indirect Labor Paid for Reprocessing	$ 244
16.	Indirect Labor Paid for Setup	$ 256
17.	Subsidy Cost	$ 87

Unrelated Data from Other Sources

100.	Available Mfg. Sq Ft	30,000
101.	Billings in Period	$34,000
102.	Machinery-Repair Costs (exc. item 14)	$ 140
103.	Dollar Value of Waste	$ 102
104.	Cost of Rejects from Customers	$ 1260
105.	Machinery Depreciated in Period	$ 600

Control Ratios Produced from Unrelated Data

A.	Productivity	$\frac{5+11}{5}$	$= \frac{1800+278}{1800}$	= 115.4%
B.	Incentive Coverage	$\frac{5}{5+6}$	$= \frac{1800}{1800+2000}$	= 47.3%
C.	Performance	$\frac{5+11}{2}$	$= \frac{1800+278}{4400}$	= 47.2%
D.	Total Indirect-Labor	$\frac{13}{7}$	$= \frac{\$960}{\$6430}$	= 0.149
E.	Excess-cost	$\frac{15+17}{7}$	$= \frac{\$244+\$87}{\$6430}$	= 0.051
F.	Billing-Payroll	$\frac{101}{1}$	$= \frac{\$34,000}{\$8181.40}$	= 4.156
G.	Billing-Space	$\frac{101}{100}$	$= \frac{\$34,000}{30,000}$	= 1.133
H.	Waste	$\frac{103}{101}$	$= \frac{\$102}{\$34,000}$	= 0.003
I.	Reject	$\frac{104+15}{101}$	$= \frac{\$1260+\$244}{\$34,000}$	= 0.044
J.	Labor-Maintenance	$\frac{14}{1}$	$= \frac{\$460}{\$8181.40}$	= 0.056
K.	Machinery Maint.	$\frac{14+102}{105}$	$= \frac{\$460+\$140}{\$600}$	= 1.000
L.	Subsidy	$\frac{17}{1}$	$= \frac{\$87}{\$8181.40}$	= 0.0106
M.	Quality	$\frac{103+104}{7}$	$= \frac{\$102+\$1260}{\$6430}$	= 0.212
N.	Incentive-Quality	$\frac{103+104}{5+11}$	$= \frac{\$102+\$1260}{1800+278}$	= 0.655
O.	Setup	$\frac{16}{7}$	$= \frac{\$256}{\$6430}$	= 0.039
P.	Setup-Cost	$\frac{16}{101}$	$= \frac{\$256}{\$34,000}$	= 0.0076

lationships between management and subordinate supervisors and foremen. That's because their communications change from a how-are-things-going-today-Joe questioning pattern to a why-has-this-fallen-down-and-if-you-don't-know-I'll-tell-you objective inquiry.

The eight composite ratios developed below not only refine the ratios previously developed, but also furnish the executive with a more sophisticated picture of the over-all production pattern:

Control I gives an appraisal of productivity, incentive coverage, and direct labor used, consistent with labor and materials waste. (Up-good. Table I: C ÷ N)

There are many events that can cause this control to vary; if it declines gradually from week to week, it is high time to find out why. Reactions to criticism may be that productivity is high and that waste is low. These claims may be true, but management must carefully point out that other factors—a rise in indirect labor, for example—have regressed sufficiently to wipe out those gains.

If the boss gets excuses rather than explanations, the real reasons for trouble are easy to pinpoint. A typical excuse is that production has suffered because of too much machine downtime for repairs and maintenance. Management needs only to consult Control VI to get the true answer.

When the excuse is that too many production trainees are hampering efficiency, Ratio L in Table I can be referred to. Soon line people realize that the boss has the answers, and that the time spent in thinking up excuses is better applied to preventing the condition from happening in the first place. As we mentioned in an earlier article—(*AM*—Apr 22 '57, p148), this realization time is shortened considerably when supervisory incentives are in force.

Control II evaluates cost excesses and supporting expenses provoked by direct labor. (Down-good. Table I: D + E + M)

This control is helpful for policing a large part of avoidable expenses, without including productivity and incentive-coverage statistics. It provides an excellent source for estimating and budgeting information. Further, it can evaluate to some extent the tendency for productivity drives to affect production economy negatively.

Control III assesses labor and materials lost by waste and rejects. (Down-good. Table I: H + I)

This control evaluates the cost of accrued labor and materials arising from poor-quality work, and is inter-related with Control II. When supervisory emphasis is placed on productivity alone, this control will have a high figure.

Control IV appraises lost labor in the payroll. (Down-good. Table I: J + L)

The labor cost of maintenance and the unrecovered cost of direct labor are considered here for budgeting as well as counselling purposes. Blaming the condition of the machines, or stating that the machines need to be slowed down below standard production speeds, are excuses that can quickly be

answered here. If a foreman cites poor machinery as a reason for low productivity, then his reasoning should be supported in the control by a higher maintenance-labor cost and a greater subsidy to direct workers whose output is sub-normal.

Control V gives the billings yield from payroll and billings. (Up-good. Table I: F × G)

Over long periods, when the effects of variations in product mix and volume mix are balanced out, this control is "the proof of the pudding." For if gains indicated by other measurements really did occur, they should show up as a greater return in billings for each payroll dollar and for each manufacturing square foot. But wait! This control is the result of two efforts: Production and Sales. A plant manager controls only the *cost value* of production. Therefore check the effectiveness of the sales staff.

This control is valid in two ways: it tells the boss if it pays for him to be in business in terms of the efforts of all his functions; and it can be used to trouble-shoot other areas.

Suppose that during several months billings per square foot decreased steadily, yet performance rose. Here is an apparent inconsistency, for if labor turned out more work per hour this circumstance should be manifested by a higher level of billings. Obviously the trouble here is an inconsistency in estimating procedure.

If selling prices were based directly on true factory costs, this condition could not exist. But with the interjection of the estimating function between production and sales, costing data may be misapplied so that selling prices become a distortion of actual shop costs. Control V will provide the needed clue.

Control VI appraises the economy of machinery maintenance. (Down-good. Table I: K)

A figure of 1.00 produced by this control states that the cost of machinery maintenance is equal to the amount depreciated on the company's general books of account. In other words, for the same dollar expense now being spent for depreciation, management could have new machines to replace the worn ones that cost so much to keep running. Naturally there are capital considerations here, but this control at least triggers the thinking process.

In plants where production scheduling is done by Linear Programming, a secondary ratio can be developed—14 + 102 ÷ 1, or 102 ÷ 101—showing the actual cost of total maintenance, which can then be added to unit costs at each producing center to modify index values. The assumption here is that LP data is based upon product rather than facility costs.

Control VII evaluates setup effectiveness and economy of order sizes. (Up-good. Table I: C ÷ O)

Over-all setup time in a given period is produced from the number of setups that occurred and the time spent for each setup. The frequency of setups relates to the size of orders, and the time at each setup assesses the speed with which it is done.

Control VIII gives the actual setup expense in the sales dollar. (Down-good. Table I: P)

This control is useful for budgeting and estimating where the facility costing method is not used. Where facility costing is employed, the setup expense is included in the hourly cost of the facility, but still this control enables management to take action without waiting for cost-recovery statements.

Table II: Composite (Tertiary) Controls

Control I = C ÷ N = 0.72
Control II =
D + E + M = 0.412
Control III = H + I = 0.047
Control IV = J + L = 0.067
Control V = F × G = 4.708
Control VI = K = 1.00
Control VII =
C ÷ O = 12.1
Control VIII = P = 0.0076

Note: For the extremely busy executive operating a business below $1-million, it might be feasible to combine several controls to determine trends only, and not specific remedial action. This carries with it the disadvantages of "averaging out" but gives data very frequently. Thus Control IX = I + V + VII; Control X = II + III + IV + VI. Control IX is an index of positive movement, Control X negative.

APPLYING THE CONTROLS

A plant making machined parts and products was in trouble: insufficient profits, a lack of stability in earning those profits, and practically no growth in the last six years. Even though sales were over $2-million per annum, management was aware of its hand-to-mouth existence. No one knew to what area sales efforts could best be applied; because of the lack of control, these efforts could not be pegged to products or cost centers of maximum profitability.

Production was more or less left up to department supervisors. Executive control by management consisted of examining profit-and-loss statements, with occasional spot checks of weekly payrolls and daily sales and shipments records.

Equipment included single and multiple drill-presses, turret lathes, screw machines, power presses, press brakes, and finishing equipment. Items manufactured were both proprietary products and sub-contracted parts. Mfg space was 50,000 sq ft.

Production records included a list of daily shipments, a list of tool troubles, and daily production tickets *by machine*. There was no operator daily time ticket, so that if an operator moved to or from various machines during a day or week, no appraisal of his efforts was available on one record. To evaluate his work, it was necessary to audit the entire batch of tickets, picking up his time and production figures on the machine tickets and reposting them to a "man" sheet. This confusion was compounded, because not all operators bothered to place their clock number on the "machine" ticket to denote what particular jobs they had done.

The office kept only a payroll journal, paying the men from weekly clock cards. There was no payroll analysis that distributed time and money among the various cost elements of production. However, at the bottom of the payroll journal, a summary classified the men into certain categories: direct labor, supervision, indirect labor, maintenance, trucking, etc. There was no provision for the indirect labor expended by direct-labor workers nor for the evaluation of the direct labor in terms of those operators' outputs. Because a large part of the profit-and-loss statement was based upon these payroll figures, it did not truly represent the monies disbursed.

An audit of the previous year's records therefore had to be made to produce a realistic statement. The (condensed) statement for 1954 was as follows:

Sales		$2,400,000
Direct Materials	$722,000	
Direct Labor	773,000	
Variable Overhead	529,000	
Fixed Overhead	352,000	2,376,000
Net Profit Before Taxes		$ 24,000

Ratio G showed that each manufacturing square foot was returning $48 per year in billings—far too low for that type of industry—indicating a low productivity of labor and a sustained fixed overhead that production activity caused by sales could not fully make up for. In other words, the amount of sales was too low to absorb this large fixed expense.

These early assumptions were confirmed by a study of direct-labor dollars in relation to sales dollars, which showed that each dollar of direct labor was returning $3.10 in sales, again far too low. And once the labor portion of variable overhead was added to direct labor to get gross payroll, Ratio F naturally showed a still lower figure.

In spite of the lack of productivity, poor condition of equipment, improper handling methods, and irregular selling practices, a proper payroll analysis was established, supported by accurate time reporting from the shop and by secondary and tertiary managerial controls. This procedure was necessary for establishing both a starting point or consistent frame of reference and a yardstick for evaluating anticipated improvements in production and sales.

No wage incentives were used in this shop at the start of the program, because of management's fear of administering them. There were a few production time standards on screw machines and multi-drills, but none anywhere else.

To have a basis for evaluating productivity throughout the shop, and to add to the over-all accuracy of estimating, time studies were made that extended production standards to every measurable operation in the plant. In addition, a cost system was installed to obtain *facility* profitability determinations. (See *AM*—Feb 25 '57, p132. Facility costing will be treated more fully in a later article.)

From all this work, this intelligence emerged:

1. The purchase of a 24-position multi-spindle drillpress was a mistake for two reasons:

LOG SHEET OF MANAGERIAL CONTROLS

Control No:	I	II	III	IV	V	VI	VII	VIII
1/7/55	0.15	1.25	0.114	0.53	1.75	1.30	2.83	0.0098
Time reporting installed.: Immediate psychological effect.								
2/11/55	0.19	0.98	0.081	0.42	2.01	1.32	2.92	0.0092
After 5 weeks: increased productivity, billing ratios; lowered waste and subsidy ratios. Payroll analysis operating.								
3/9/55	0.32	0.79	0.072	0.29	2.19	1.26	2.98	0.0081
After 4 weeks: reduction of maintenance and indirect labor; increased productivity, higher billing ratios. Time studies started in mid-January. Coverage of key operations completed in mid-May.								
5/18/55	0.56	0.69	0.067	0.24	2.41	1.19	3.11	0.0079
Continuation of above efforts. More realistic estimation produced rises in productivity and billing dollars. First cost-recovery statement produced from machine-hour-rate (facility-cost) system. Management began to sell selectively the most profitable facilities.								
7/16/55	0.69	0.53	0.061	0.16	3.66	1.20	3.19	0.0079
After two months: lower reprocessing costs and higher billings per hour and per square foot. Because Control V was more the result of physical condition than labor effort, some machines were replaced with new ones. Replacement schedule followed new policy of selectively selling facilities with some shifts in product mix; consequently some machines were eliminated.								
12/31/55	0.78	0.47	0.057	0.12	5.82	0.81	3.24	0.0076
End of year showed healthy profit trend. (See 1955 P & L statement elsewhere.) October 1955: data collected for supervisory-incentive plan, installed in December 1955.								
4/2/56	0.83	0.28	0.056	0.11	7.20	0.60	3.30	0.0077
After 4 months: considerable reductions in indirect labor, waste, machine wear, time lost waiting for materials, and delivery costs. Average productivity had reached 75 to 80%. Production wage incentives for direct and indirect-labor people installed in May.								
12/31/56	1.43	0.14	0.039	0.03	11.32	0.39	4.60	0.0049
Results from incentive plan and all previous efforts at end of 1956. (See P & L statement for 1956 elsewhere.) Results include intensive efforts of selective selling: appraisal of markets, products, geography, potential, saturation, etc.								

a. The time needed to position 24 castings in the jigs, plus the drilling-cycle time divided by 24, was in excess of the time needed to drill each casting on a manually fed single-spindle drillpress.

b. Besides tying up a large amount of working capital, the multi-drill required an activity of 6000 hours annually to absorb the investment the company had made in it. This cost center, however, averaged only about 1100 hours per year. Had the company used the facility method of costing, this discrepancy would have been apparent immediately, in terms of the unsalable high estimate produced.

2. Over-all plant productivity averaged 55%. Normally, management can expect a maximum of 80% in a daywork shop. Workers just won't deliver a standard fair day's work unless they can look forward to bonus money above that level. The machine-paced operations—such as the screw machines and the automatic roll-feed punchpresses—produced above this level; the manual presses, brakes, and polishers averaged below it. This made Ratio L high.

3. The foremen were chiefly concerned with delivery, especially with the parts farmed out to them. Waste and rejects were high, in-process inspection was haphazard, and Ratio D showed an inordinately high amount of sustaining indirect labor. This latter factor was produced by high trucking expenses caused by frequent deliveries in duplicate areas (little planning or scheduling); an excessive number of

materials handlers; a high ratio of unproductive labor to direct labor; and a high level of reworked parts.

4. Low output from automatic and semi-automatic equipment (not operator-paced) was caused principally by the condition of the machines rather than by excessive downtime for setups. Ratios K and O clearly showed this. Ratio K was averaging 1.30, so that the cost of maintenance and repairs on equipment was 30% higher than their depreciation expenses. If this information had been available in the past, some of the equipment would have been replaced; the effective capacity of the plant would have increased and the unit costs of manufacture would have decreased. It is interesting to note that part of the capital for these purchases could have come from *not* buying the multi-drill.

The exhibit reproduced on page 100 is a log of the movement of managerial controls over a period of two years.

A glance at the exhibit will show that by the end of 1955, the benefits of the controls were already apparent. A condensed statement for the year ended 12/31/55 can be compared with the 1954 statement:

Sales		$2,800,000
Direct Materials	$812,000	
Direct Labor	840,000	
Variable Overhead	616,000	
Fixed Overhead	364,000	2,632,000
Net Profits Before Taxes, 1955		$ 168,000
Net Profits Before Taxes, 1954		24,000
Profit Increase, Net		144,000
Cost of Controls and Improvements (including finance charges on new equipment)		14,000
Net Dollar Gain		$ 130,000

A more detailed analysis of the expenses for the two years shows that while sales increased $400,000, or 16.7%, costs of direct materials rose only 12.5%, direct labor 8.7%, variable overhead 16.4%, and fixed overhead 3.4%. Obviously the controls, by exposing profit leaks and stopping them, paid off.

The advantages gained from further refinements are evident from a comparison of the condensed statement for the year ended 12/31/56 with the statement for 1955:

Sales		$4,100,000
Direct Materials	$1,148,000	
Direct Labor	1,106,000	
Variable Overhead	820,000	
Fixed Overhead	411,000	3,485,000
Net Profits Before Taxes, 1956		615,000
Net Profits Before Taxes, 1955		168,000
Net Profit Increase		447,000
Cost of Improvements, Finance Charges, and Added Sales Expenses		29,000
Net Dollar Gain Over 1955		$ 418,000

It should be noted that wage incentives were in effect for the last seven months of 1956. The advantages of this program, together with the gains realized from all the other controls instituted under the improvement plan, have enabled the company to forecast a budget for 1957 that shows a projected 19% net profit.

Manufacturing space (50,000 sq ft) remained the same throughout the program. Billings yield per square foot increased from $48 in 1954 to $82, chiefly because of proper costing and estimating, selective selling, and calculated replacement of equipment. Billings yield per direct-labor dollar increased from $3.10 to $4.00; here the gain came first from policing productive workers and then from stimulating them with wage incentives.

Results of the two-year program show striking improvements:

	1954	1955	1956
Sales	$2,400,000	$2,800,000	$4,100,000
Fixed Overhead	$ 352,000	$ 364,000	$ 411,000
Increase in Sales	0	16%	46%
Increase in Fixed Overhead	0	3.4%	13%

The non-linearity of expense increases in fixed overhead from 1954 to 1956 should be noted. The percentage rise in sales was much greater than that in fixed overhead. The added activity absorbed expenses unrecovered by previous sales and also reduced unit fixed-overhead costs as activity surged.

INTEGRATING OPERATIONAL DATA

Company profits are not determined by the autonomy of production, sales, or capital efforts but by an integration of all three areas. An evaluation of the capacity and economy of machinery operations, for example, must include capital and sales considerations; otherwise, shallow decisions will result.

Considered separately, each of these three areas is non-linear; inter-related, they become much more complex. When the human element is introduced, in the form of forecasts that affect future operations, the problem calls for the technique of Operations Research. Controls for sales and capital, and how to integrate them with production, will be discussed in future articles.

Feedback Quiz

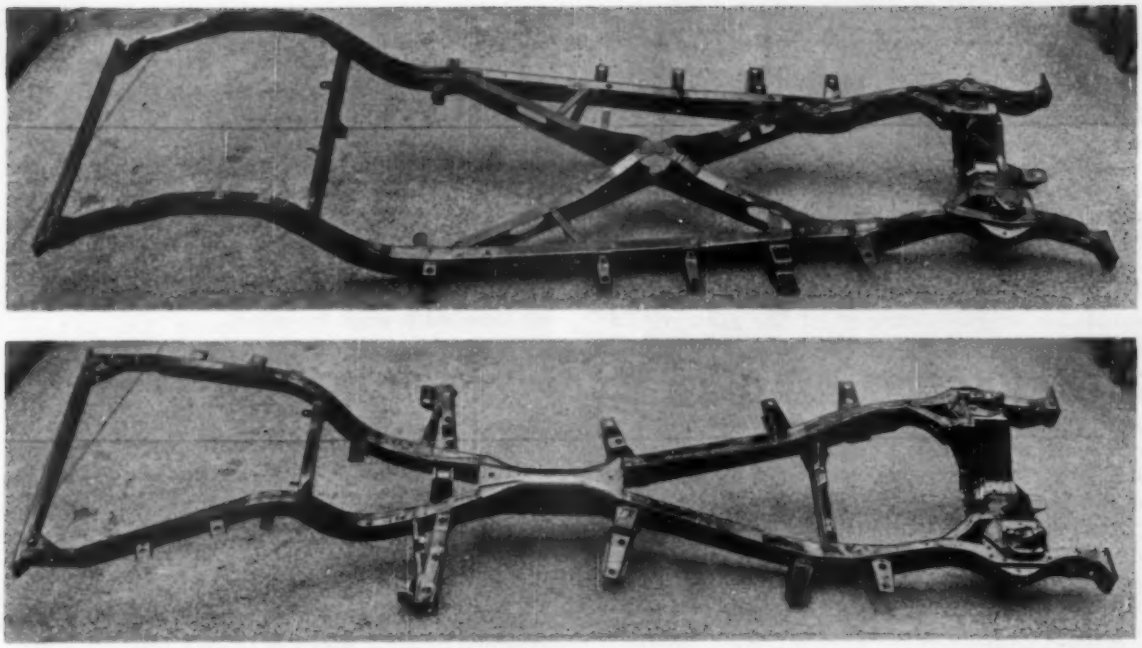
1. ***Why can't you say that automated equipment reduces cost below that for manual equipment?***

2. ***Is it possible for Control I to show no movement despite increases in materials waste? Why?***

3. ***Which of the tertiary controls evaluates the profitability of a piece of equipment?***

4. ***Will low productivity reduce subsidy costs?***

5. ***Which is the sharpest control for evaluating the cost of below-normal production?***



New X-frame permits lower lines for Cadillac but requires new concepts in frame manufacture

Hydraulic fixtures hold frames for welding, aligning, piercing

A new type of frame permits a lower silhouette on the new Cadillac, but it created problems in fabrication. A O Smith Corp solved them by breaking the frame down into two subassemblies

NEIL GRANBERG,
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Underneath the sleek, low-slung lines of this year's automobiles, there were a great many engineering and production problems that had to be solved before the new cars could be manufactured and introduced to the public. 'Way down under the 1957 Cadillac body, for example, there is a brand new type of frame, because the design just couldn't go any lower unless a new concept was introduced. The floor was in the way, and road clearance was already down to a minimum.

To solve this problem, the Automotive Research and Engineering Dept at A O Smith Corp in Milwaukee developed an X-style or "backbone" frame, which enabled the floor to be lowered and still meet minimum ground clearance. In fact, the "backbone" frame encases the car drive line under most of the floor pan. Thus, it requires little more clearance than the drive line itself, *and* the relocation permits the floor to be lowered a minimum of 3 in.

MANUFACTURING PROBLEMS

But the new idea only moved the problem one step further along: into the manufacturing area. One of the difficulties concerned the 1500- and 2000-ton forming presses. The wide sweep of the side rails on the new frame would have required presses with a much greater shut height.

Storage was another problem. The standard handling containers, which had a capacity of 40 to 60 of the old-style rail parts, would have held only about 14 of the new wide-swept rails. Therefore, the space requirements and the material handling costs would both have increased alarmingly. Once again, a new concept was sorely needed.

It was found in the idea of splitting apart the front and rear portions of the frame, manufacturing them as subassemblies, and then welding them together in a "marriage" fixture. But this was not the end of the problems.

Tolerances were already uncomfortably close. Cadillac engineers had stated early that holes in the frame for attachment of motor and drive line would have to be held closer than heretofore believed

possible. And the new method—joining the two subassemblies together at the narrow center section—would only add to the difficulty. As a consequence, great care was taken in designing the assembly and inspection fixtures.

Exceptionally strong fixtures were required because of part rigidity and because of the need for positive clamping and accurate locating. Therefore, hydraulic operation was deemed a necessity. Carefully selected pilot holes were established on all frame components, and the fixtures were equipped with generous-sized dowels and numerous hydraulic cylinders.

MANUFACTURING OPERATIONS

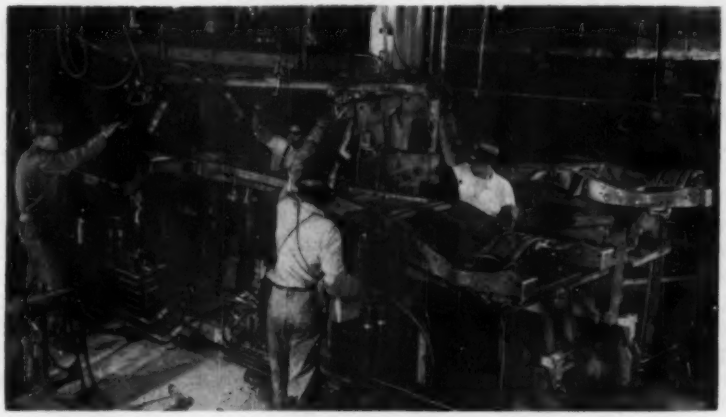
In the subassembly area there are separate lines for the front and rear halves of the frame. Here, the press-formed, sheet-steel parts are tack- and finish-welded in hydraulically operated fixtures.

Next is the "marriage" fixture. Like the subassembly fixtures, it operates on a clamping pressure of 1000 psi, holding the frame components tightly against locating pins and pads for tack welding. When work at this station is completed, the clamps are released, and toggle-type jacks raise the frame above the fixture to a special grab-and-hoist unit which transports it, via tramrail, to a final welding station.

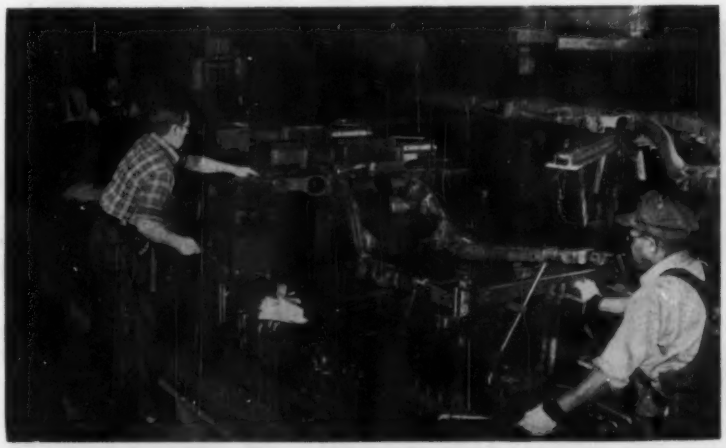
Because of the large amount of welding on the Cadillac frame—750 to 1030 in., depending on the model—a cooling conveyor has been provided to allow the welded assembly to cool down to room temperature. Then an automatic transfer pusher moves it into position on the qualifying fixture, a straightening device which aligns the frame so that all important surfaces and attachment holes will later meet the exacting dimensional requirements of final inspection.

This fixture is equipped with eight hydraulic cylinders in addition to those required for clamping. Each of the eight is capable of exerting several thousand pounds of pull or thrust at carefully selected locations. Once a frame is clamped in position, the operators determine what correc-

Hydraulic "marriage" fixture holds subassemblies . . .
in alignment for tack welding. Frame is clamped in upside-down position, and top junction plate (shown in box in foreground) and various brackets are added. Angle-iron frame at right holds next front-end subassembly

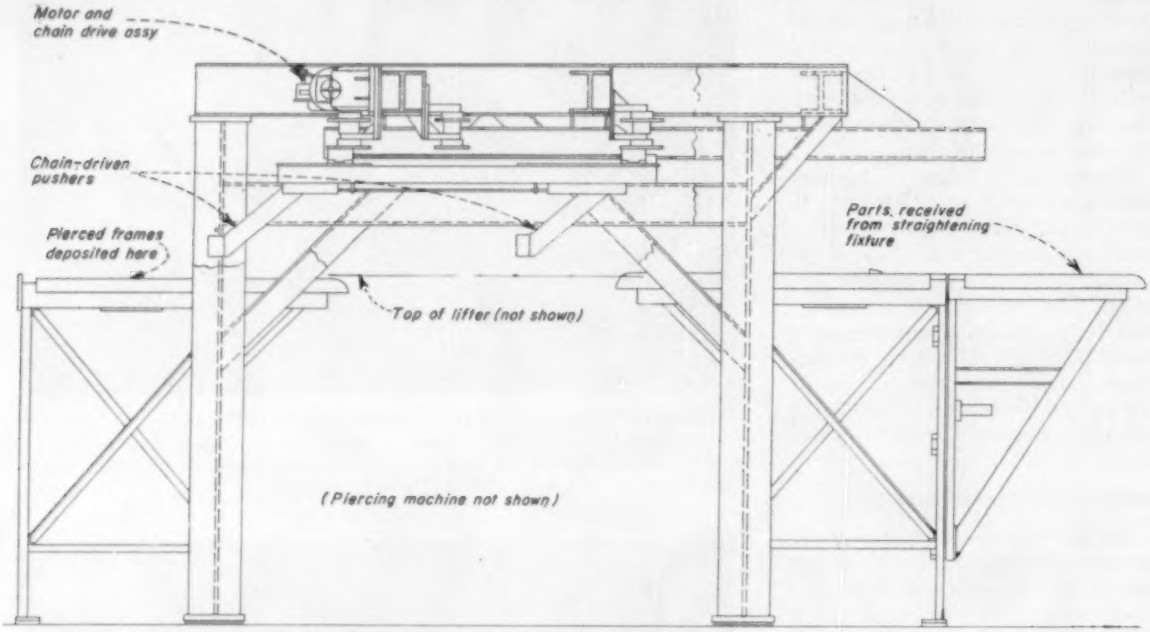


Tack-welded frame is raised from fixture . . .
by toggle-type jacks. Grab-and-hoist unit suspended from tramrail moves assembly to final welding station



Qualifying fixture straightens Cadillac frames . . .
to meet exacting specifications on alignment and hole location. Spring-loaded gage pins, like the one in front of operator at right, must fall into gage holes when frame is in a free state

Hydraulic fixtures hold frames for welding, aligning, piercing . . .


Motor and chain drive assy
Chain-driven pushers
Pierced frames deposited here
Parts received from straightening fixture
Top of lifter (not shown)
(Piercing machine not shown)

Transfer system loads heavy frames . . . into piercing machine. Chain-driven pusher fingers and lifter handle the part all the way through the operation and deliver it to a conveyor at left

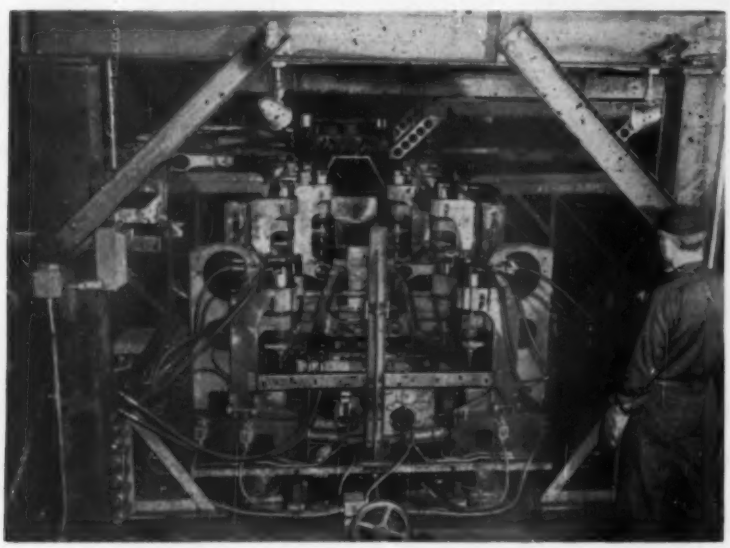
tions have to be made and then actuate the necessary cylinders to twist or bend the frame and bring it into alignment, as indicated by spring-loaded gage pins. When the gage pins can be inserted in the appropriate pilot holes while the frame is in a free state, it is moved on to the following operation.

An automatic transfer system pushes it into location over an elevator which lowers it into the hydraulically operated hole-piercing machine. Here, the aligned frame is located on gage pins, and all body-mounting holes are pierced.

A special feature of the piercing machine is that the piercing heads are individually mounted on sliding bases so they can be repositioned when frames for different models come through the line. Another feature is that the piercing cylinders operate at a boosted hydraulic pressure of 5000 psi, in order to minimize cylinder size and permit mounting the punches on close center distances when necessary.

After body-hole piercing, the frame is transferred to the paint shop by conveyor.

Inspection is performed on a statistical quality control basis. At periodic intervals, frames are taken from the hole-piercing machine and placed on the final inspection fixture. Well-trained inspectors check all frame points covered by gage stands and record their readings on a continuous chart. When this quality control record shows the readings drifting toward established maximum or minimum limits, corrections are made on the production lines to maintain the desired quality level. This careful checking of the product, as well as the close tolerances held on alignment and hole location, provide for fast and accurate body mounting at the Cadillac Assembly Plant.



Mounting holes are pierced . . . in this elaborate hydraulic fixture. Parts are delivered from the right by an automatic pusher and lowered into position in the fixture by a self-contained elevator. Piercing heads are mounted on sliding bases and can be repositioned for different frame sizes

Round Table...

Setup Squabble

"What's the war going on in Personnel for, Al? I walked by a while ago, and it looked like you were going to start swinging."

"It's that trouble I had this morning with Campbell, Ed. I told you he ruined about a dozen of those special manifold blocks. Naturally I fired him; especially because he was given a plug gage and told specifically not to keep drilling if they didn't check out OK."

"That's no reason for all the fuss and feathers, Al."

"Well, when I found out that he hadn't checked the holes he was drilling, I told him he was through because of irresponsibility. But as soon as I turned my back he had the shop steward in on the act. Now they claim it wasn't his responsibility at all, but was the fault of the setup man."

"Well, if you ordered him to inspect the holes, and he didn't, that sounds to me like he definitely goofed."

"That's what I thought, Ed. But evidently Personnel is half convinced the shop steward is right, because they're trying to soft-pedal the whole deal. Campbell claims it was the setup man's fault he drilled too deep, and it looks like he's going to get away with it."

"Of course, you'll have to admit that having a machinist do his own inspection is contrary to normal practice around here, Al. Maybe you should have gotten some kind of special work order from the brass to make sure Campbell knew what he was supposed to do."

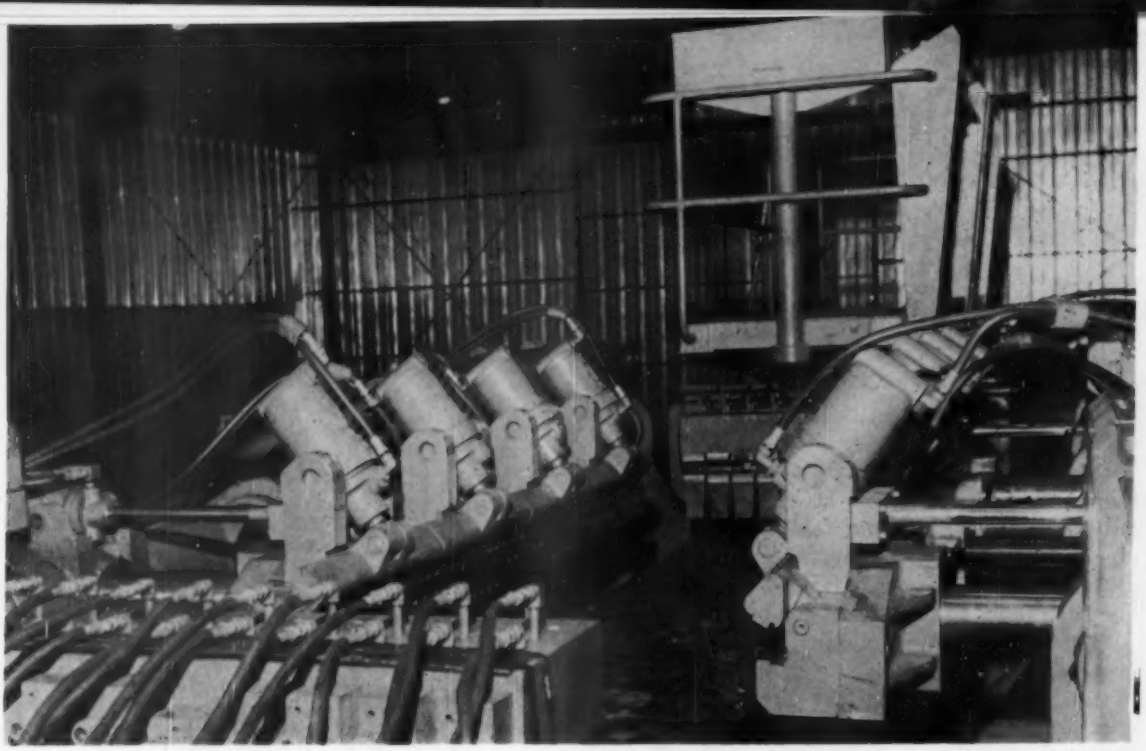
"I didn't have time, Ed. Besides, it was a direct order from me to him. If they get around that point, I might as well quit trying."

"Maybe Campbell can claim he had no experience as an inspector and shouldn't therefore be asked to do inspection work."

"Experience! How much experience does a man need to handle a simple plug gage? Any good machinist can use one. As far as I'm concerned, this proves that Campbell is not a machinist, no matter what the front office decides."

• • •

***SHOULD** Al have fired Campbell because he didn't check the holes he was drilling, or should he take into consideration the fact that usual practice in his shop is to have separate inspection? Your opinions may help others. Discussions of earlier topics starts on page 164.*



Four of the twelve sections . . .
of side jaws are in working position in this view of new bi-axial stretch press. All motions are controlled from the console at the far end of table

Two-way stretch forms

The supersonic Titan ICBM requires integrally stiffened skins stretch formed to airfoil tolerances. New bi-axial stretch process works from extruded skins to make this possible

A practical solution has been found to the problem of forming integrally stiffened skins for aircraft and missiles. This solution (see cover) is a machine that provides stretch in both directions in the horizontal plane plus a vertical travel of the die.

Three distinct forming methods are possible in the resulting machine:

1. Part held in the side jaws and stretched by the end jaws.
2. Part held in side jaws and stretched by moving the die.
3. Part held in side and end jaws and stretched bi-axially by moving the die.

First machine of this design has been built for the Martin Co. It will be used by Martin's Denver Div to form skins for the Titan ICBM (Inter-Continental Ballistic Missile). Concept of the machine was evolved by Hufford Machine Works (who built the machine), Martin (which is building the Titan airframe), and Ramo-Wooldridge Corp (which is supplying systems engineering on the ICBM). Overall responsibility for the ICBM project rests with the Air Force's Ballistic Missile Division in Inglewood, Calif.

THE PROBLEM

Increasing use of integrally stiffened skins, initially produced by machining from solid plate, has presented a major challenge in stretch forming because existing stretch presses were designed to handle either sheets or sectional shapes.

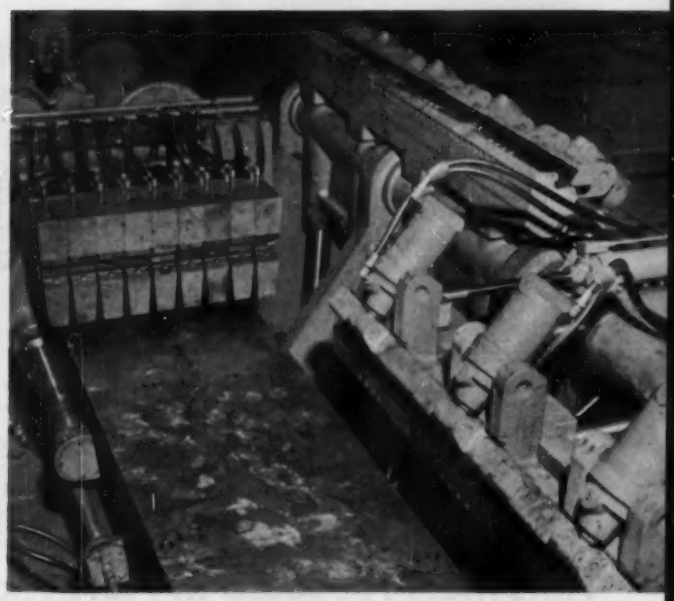
With the large extrusion presses available in the Air Force heavy press program, it has been possible to extrude integrally stiffened skins in wider and heavier sizes that eliminate machining from plate in some cases and provide a more economical product. Some designs can be stretch formed on conventional machines, but often require special, complex tooling. Some designs cannot be stretch formed at all on existing machines.

The large difference in the mass of the stiffeners in relation to the skin thickness makes it virtually impossible to achieve an airfoil or smooth surface on the unribbed side of the part—a concave or convex surface condition is usually created along each rib line.

THE SOLUTION

The bi-axial machine was designed to handle integrally stiffened skins up to 5 x 24 ft. Other requirements were that it handle 2014-T4 aluminum up to 14 sq in. in cross section longitudinally and 46 sq in. in cross section transversely. Transverse stretch form-

Skin for Titan missile . . .
rests on the form die used in bi-axial machine. Lugs on outer edges are held by side jaws to prevent necking without limiting longitudinal movement of skin as it is stretched



End jaws are pin-mounted . . .
in fittings in radial grooves in the yoke, can be adjusted for part contour and can shift with transverse stretch. Side jaws not in use can be seen swung to their vertical position

missile skins

ing was to be from straight to a 30-in. radius, but with no compound curvature.

The resulting machine, which was engineered and built in 150 working days, has a die table powered by two 700-ton cylinders. To keep the table level during forming, the cylinders are provided with a servo system that regulates the oil flow and maintains the table horizontal within 0.001 in. per ft while the table is raised.

Each pair of hydraulic cylinders powering the end jaws provides a longitudinal stretching force of 365 tons. These are also synchronized through a hydraulic servo control so that each pair of cylinders will provide exactly half of the longitudinal stretch.

Side jaws are built in sections with a holding force of 60 tons per running foot. Each set of side jaws is made up of twelve individual sections. These can be swiveled out of the way when not needed. The side jaws do not grip the part, which would prevent longitudinal stretch, but retain it against necking around a lug extruded in the edges of the sheet.

FORMING TITAN SKINS

In forming the Titan skins, it is necessary to maintain the dimensional relationship of three stiffeners in each panel. This is accomplished by using the first of the three methods listed at the beginning of this article: Part held in side jaws and stretched by the end jaws.

The panels are extruded in a circular form, flattened, and milled to uniform web thickness. This panel is placed in the press and retained by the side jaws (which are adjustable in and out by hydraulic cylinders during setup).

The die table is then raised to impart the transverse contour. End jaws are extended to the panel ends and gripping segments are adjusted to the part contour. Segment links are pin mounted so they can spread transversely with the stretch of the part to prevent buckling and wrinkling. Gripping elements in the end jaws are of wedge design with serrated gripper plates and are closed by hydraulic cylinders.

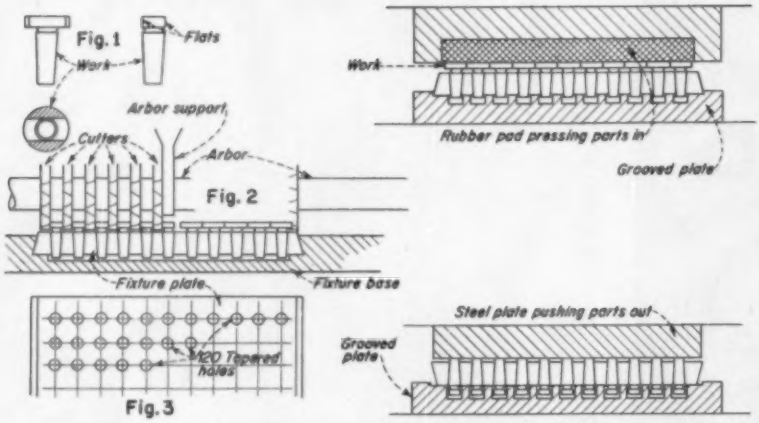
Forming is completed by stretching the panel longitudinally to "set" the curvature applied by the die table.

After forming, the panel is completed by extensive chemical milling to further reduce the skin weight. Freedom from residual stresses is indicated by the lack of deformation in the contour during this operation.

Because the machine encompasses the part, getting the work in and out of the machine becomes a problem. (The machine is 40 ft long, 16 ft wide, and set in a 12-ft pit.) To solve this handling problem, the machine will be equipped with a handling device using vacuum pads. This unit will be supplied by Vac-U-Lift Co.

The initial production run has demonstrated that bi-axial stretch forming will produce integrally stiffened skins to the tolerances required for supersonic speeds. Further, it has demonstrated that similar, more universal, machines can be built for more complex shapes than the single curvature now possible.

Practical Ideas



Flats Mass-Produced in Plate Fixture

We had to mill two flats on tapered pins, as shown in Fig. 1. All other dimensions had been turned in great quantities on automatic screw machines. The material in these pins was high-chrome steel. The method of clamping the parts loomed as an obstacle until we designed the fixture shown in setup (Fig 2).

The most important part of this fixture was, of course, the work-holding plate Fig 3. For obvious reasons, the 121 tapered holes it contains should be drilled and reamed in a jig borer to assure accurate spacing. Their locations were so calculated as to allow us to utilize the ordinary side milling cutters we had on hand.

Two additional plates were used for loading and unloading. One of them was grooved to provide clearance for the 11 rows of parts. The other was milled out to receive a rubber pad which was used to press the parts evenly into place.

Loading the parts into the work-holding plate while it is supported by the grooved plate is done by hand. The rubber-loaded plate is then placed on top of the work-pieces, and with an assist from a press ram, the pins are uniformly pressed into their respective holes.

The fixture plate is then moved to the milling machine and onto a fixture base where a pair of fast-acting clamps locks it. Climb milling is used to prevent the parts from pulling out. A special arbor support is necessary to reduce deflection of the arbor.

After a table travel of about 10 in., 121 pins are milled and the fixture plate returns to the press. Here it is turned over on the grooved plate and, with a solid flat plate, the pins are pressed out.

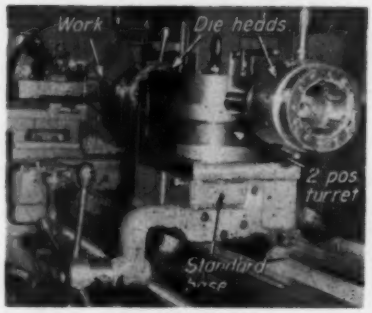
A Vetsch, Seuzach, Switzerland

Multiple Tool Holder Speeds Machining

Faced with the job of cutting to length and turning four diameters on bronze castings in large quantities, and with only an engine lathe on which to do these operations, I designed the multiple toolholder shown in Fig 1. This toolholder allows us to perform all these operations in one pass of the toolbits.

A piece of square CR bar stock makes up the body of the holder. Four holes are carefully laid out, drilled, and broached to take the carbide-tipped toolbits selected. By properly spacing and adjusting each toolbit for depth of cut, long runs can be made without further adjustments. The holder is mounted on one side of a square turret tool post.

Each casting, after machining, also calls for a 3 in.-12 tpi straight thread, and a 2½-in. 8 npt. Ths



was accomplished with a quick-opening die head for each thread. A base for a tailstock to fit our lathe was purchased. On this we mounted a two-position turret to hold the two die heads, as in Fig 2.

Machining time has been cut from 25 min to 7 min per piece, including setup of multiple cutter and turret head. Incidentally, the turret can easily be adapted to additional positions if necessary.

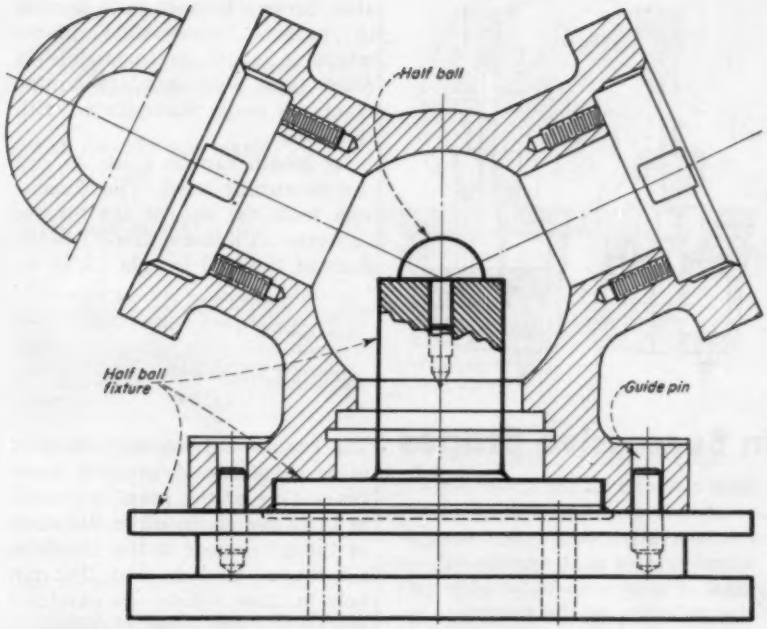
Stuart E Uellman, Batavia, NY

Infra-Red Lamps Dry Molds

We often make small castings in sand molds. To get them sharp it is necessary to extract all moisture from the sand. The easiest way to do this is to subject the open mold to a pair of infra-red lamps. The penetrating rays dry the sand in a few minutes.

Large capacity shades were made from a couple of 5-gallon cans. The tops were cut out, and lamp sockets were soldered into holes cut in the bottoms. One can was inverted over each mold, concentrating the rays for efficiency.

S Clark, East Bradenton, Fla



Half-Ball Fixture Sets Up Work for Boring

The casting illustrated has a central round cavity with two cored holes leading into it. We had to machine this casting to accurately finished bores, counterbores, and recesses, and at the same time make all holes intersect at the center of the cavity. The most practical way to go about it, and afterwards have a means of checking our accuracy, was to make a half-ball fixture as shown.

After the bottom flange and bores had been machined according to specifications, a fixture was made, its height to coincide with the central point of the intersecting bores. A half-ball with a centrally located shank was then mounted in a concentric hole on top of the fixture.

The bottom flange had an even number of bolt holes. Two of these holes, 180° apart, were selected and carefully bored to serve as tooling holes so we could index the casting. This made only one setup of the angle bores necessary and eliminated the need for a rotary table. After mounting the fixure on a sine plate at the specific angle, we were prepared to find the center of the bore with an indicator zeroed against the half-ball. Lengths of bores and depths of counterbores were readily checked against the surface of the half-ball.

This idea can be utilized for a lot of such setups. Most angles required for boring or drilling are under 180°, or else the setup can be adapted to include angles less than 180°, which permits using only half a ball for setup and measurements.

Indicating to the surface of the half-ball when setting up the boring spindle was fairly easy; certainly much easier than working without such a convenient and accurate setup aid. Measuring exact bore lengths without this aid would have been next to impossible.

Joseph G Maceyka, Link Aviation, Binghamton, NY

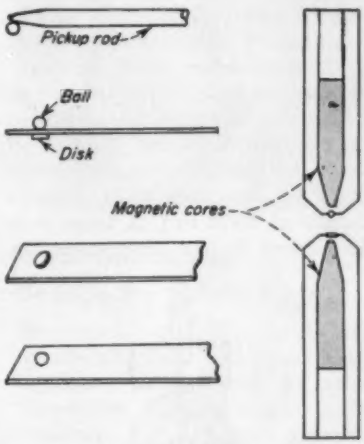
Magnetic Electrodes Hold Small Parts

Short setting time and high setting accuracy should be the goals when you plan a spotwelding job. But these factors are often difficult to combine, especially when the work is so minute that you have to use tweezers to handle it.

It can readily be seen how difficult it would be to arrange the small parts, shown in the illustration and to place them accurately opposite each other on either side of a plate without the benefit of special tooling. In fact, without such tooling, small balls and flat plates with diameter less than 1 mm are apt to be lost before they reach the electrodes.

To make the job easier we developed the magnet-cored electrodes, also shown. These electrodes are hollowed out and fitted with magnetized rods arranged to hold opposite magnetic poles at the electrode points.

Nesting the parts on the electrodes is done with the help of a small dia . rod of less magnetic

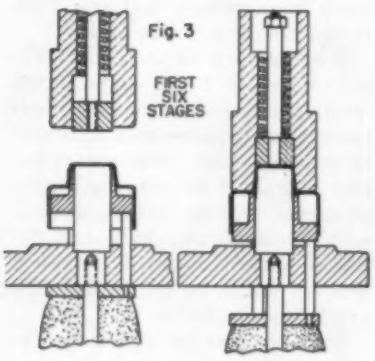


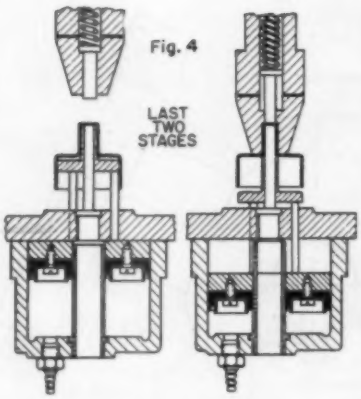
power than the electrodes. A ball or a plate is picked up by this rod and brought to the proper electrode. The part will then be attracted to the superior magnet of the electrode. A thin non-magnetic coating on the pickup rod permits easier release of the parts in nesting.

When both parts have been properly placed, the plate to which they are to be welded is inserted. The electrodes are then brought together as usual and a difficult spot welding job is accurately completed in the least setting time.

Jiro Yamazaki, Tokyo, Japan

Practical Ideas





Drawing Small Dia In Successive Stages

The part shown in Fig. 1 is drawn from one piece of sheet brass. The tensile strength required in its application to radio apparatus prohibited two-piece construction. Piercing and crimping is done in other operations and will not be discussed here. Our chief concern is the deep-drawn small-dia cylinder projecting from the larger cup.

The cup is drawn to completion in the first draw to a depth of 0.550 in. (allowing enough metal to trim the edge to a finished height of 0.472 in.). A large wart is formed in the first operation.

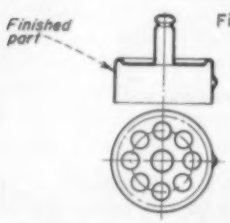
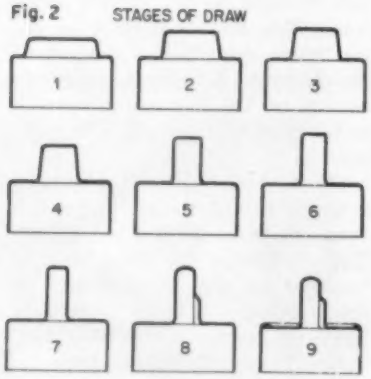


Fig. 1

Fig. 2 STAGES OF DRAW



This contains all the metal for the small-dia cylinder. Fig. 2 shows the successive stages necessary to complete this part, equalizing the draw in each step to avoid excessive thinning of the material.

As much as 20 to 30% reduction of the diameter on each consecutive draw is not unusual in this type of work, but because of the hardness of this material we could reduce the dia only by 12% per draw. Annealing is necessary after each operation. The six successive drawing dies are of the same design. The part is placed on the die as shown in Fig. 3. As the drawing punch descends, the cup is held by a spring-loaded ejector, and the guide is forced down against a rubber bumper which later strips the part off the die.

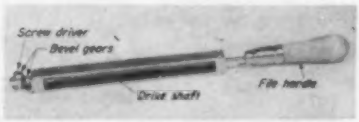
The last two operations are performed on the die shown in Fig. 4. The first of these forms an internal keyway, and the last forms a disk indentation on the face of the cup.

Hjalmar Dahl, Upplands Vasby, Sweden

Right Angle Screw Driver Works in Close Quarters

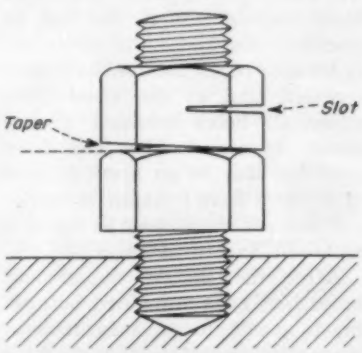
In our field of mechanical assembly, as well as relating semi-mechanical branches, such as the servicing and assembling of computers, recorders or other electro mechanical devices. The usefulness of the illustrated device is invaluable. Screws, bolts or nuts, located in narrow, inaccessible places where it would be impossible to reach them with standard equipment, are easily manipulated with this tool.

Its length can be made to suit the particular need. The dimension from the end of the bit (in this case it's a screw driver) to the back of the tool is only 13/16 in.



The angular driving mechanism is made up of two ½-in.-pitch bevel gears. One of the gears is pinned to the drive shaft, while the shaft of the other gear is the shank of the bit, or wrench used. The pin hole in these shanks are carefully drilled to make them interchangeable.

K F Theobald, Link Aviation, Binghamton, NY



Altered Nut Removes Stud

When limited space forbids the use of a standard stud remover, an altered nut backed up by a full nut will usually pull the most stubborn stud. A slot is cut slightly less than half way into the side of a nut. The landing face, opposite the slot, is then ground to a taper.

When the two nuts are pulled up together, a gripping action on the threads takes place. Torque applied to the full nut will remove the stud, if it's at all removable, without damage to the threads.

Harry Miller, Sarasota, Florida

S G WOOLLEY
Gainsborough, England

won $25 in addition to regular payment for his idea:

DRILL FIXTURE FOR MANY BOLT CIRCLES

in the April 22, 1957 issue

An extra $25 will be paid for the best Practical Idea in each issue of *American Machinist*. Selection of the winner is made by a group of our readers.

Our annual Production Planbook will reprint all winning ideas as a review. One will be chosen out of this issue as a winner of winners, and will receive a

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JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

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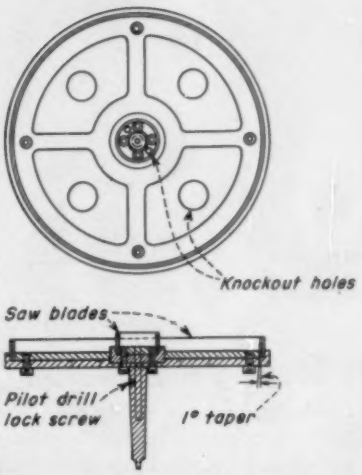
HOW TO ENTER — Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N. Y.



Cutter Uses Bandsaw Blades

I have found the illustrated cutter very useful for cutting disks in plastic, fiber, plywood and similar materials. Not only is it fast working and safe, but it also produces a good finish on the parts.

We formerly used to cut out the ID, or hole, with a standard cutter. The OD was then sawed out on a bandsaw and dressed on a disk sander. The cutter I made cuts both diameters simultaneously and concentric to each other. The 9-in. OD by 1½-in. ID cutter shown will cut through ⅛-in. material in less than a minute as compared to about 7 minutes by the old method.

The machining is done according to the drawing. A tapered shank is welded to the main plate, after which the face of the plate is turned to specific diameters. The ID cutter is a separate unit inserted in a concentric recess of the main plate, and held by four screws. A clamping ring holds the OD cutter blade. Four sections of this ring are removed to reduce weight.

Several holes through the main plate give access to the part after it has been cut so it may be knocked out. A hole is drilled in the center, up into the shank, for a suitable pilot drill. The drill is secured by a setscrew inserted through the side of the shank.

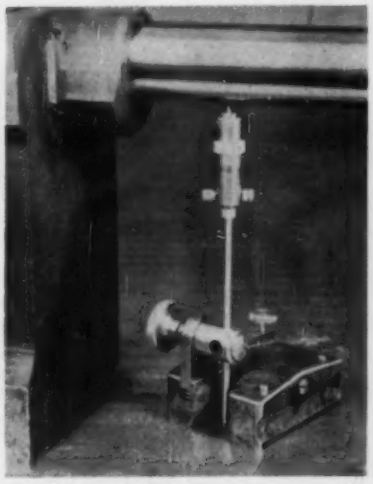
Blades are metal cutting bandsaw blades with 6, 8, or 10 teeth per inch, ¾ in. or 1-in. wide.

R C Gordon, Bangalore, India

Acid Cleans Rusted File

A badly rusted file can be cleaned with the aid of a little muriatic acid, applied undiluted. Allow acid to remain on the file for a few minutes, then rinse thoroughly. If necessary, repeat. When all rust has been removed, soak file for ten minutes in a solution of soda and water to neutralize any acid left on the file. It should then be rinsed and dried thoroughly.

R Miller, Lansing, Mich



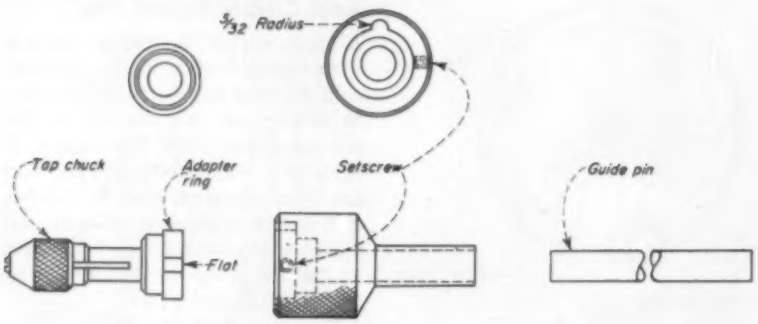
Inside Micrometer Doubles For Height Gage

We often use the illustrated scheme when our height gages are in demand on other jobs. An inside micrometer so applied is a useful substitute for a height gage on surface-plate inspection jobs or when checking parallelism of a boring bar in a boring mill, milling machine, or similar setup.

The micrometer is supported vertically by gripping the measuring rod of the micrometer in the lower sleeve of the surface gage. The rod will usually fit into the sleeve hole normally intended for the scriber. If accurate readings from bar to surface plate or machine table are intended, the end of the rod should, of course, contact the plate or table tightly.

H J Gerber, Stillwater, Oklahoma

Practical Ideas



Snapping A Tap Changed To Tapping A Snap

A machinist may say (with his tongue in his cheek), "I have never broken a tap." But more than likely he'll have experienced the sinking feeling that goes with the crunching sound of a breaking tap. Many times it will happen when the job is ready to be handed to the boss. Before the advent of the tap extractor, this was reason enough for a man to blow his top.

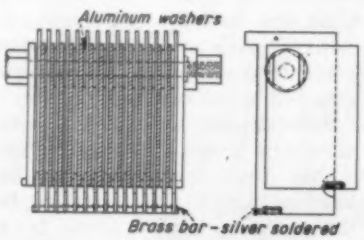
Working with metals and materials that behaved like chalk, there was always the fear of jamming the tap or stripping fine threads. It was then that I designed the illustrated tap holder. Originally, the device was designed for tapping, but the tool worked so well that a button-die holder was incorporated.

Some of the advantages are: Tap or die will be automatically centered. Tap failures are reduced. Standard taps and button dies (13/16 OD in sizes from 0 to 10) may be used. Cleaner threads without stripping result in such materials as phenolics because "feel" governs the rate of feed. Tool can be used in either a lathe or drill-press.

The drawing shows the three parts of the tool: The tap chuck, the body, and the guide pin. The tap chuck is a purchased T-handle which was altered by removing the pin and fitting it with an adapter ring to bring the shank up to suit the 13/16-in. counterbore in the body. The guide hole in the body was bored to a sliding fit over the guide pin, which was either a long dowel or a length of drill rod. An 8-32 setscrew locks the die or tap chuck in the body.

The photo demonstrates method of holding the tool as it's applied in a rod-threading operation. Approach is the same for tapping. Thus held, the tailstock is brought forward and the die is started on the rod. Power is then turned off, and while the lathe is coasting to a stop the die is fed onto the rod. Pressure exerted by thumb and forefinger controls the cut. Should the die or tap bind, pressure is released.

Samuel J Yasho, Los Angeles, Calif



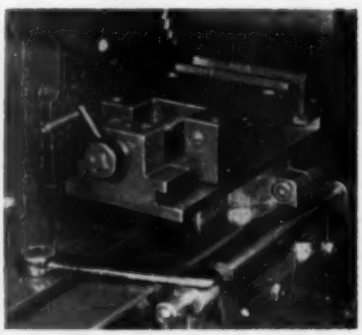
Magnetic Blocks Adjust To Any Angle

This type of adjustable magnetic block should be useful to any shop doing a variety of surface-grinding jobs. The design was chosen because of the simplicity of construction, requiring only a minimum of material.

Making these blocks in pairs, grinding them in unison, will provide a means of holding long bars for grinding to angles from 0° to 90°. Angles are set by first loosening the nut on the side, then setting the top 'hinged' section to the angle desired, and retightening the nut.

The blocks are made of 1/16-in. CRS plates except the two end bars which are ⅛-in. thick for added strength. Aluminum spacers, in the form of washers, are also 1/16-in. thick. A slot is milled on each of the two blocks (across the ends of the plates, away from the bolt) to receive a brass bar. These bars are silver soldered to the plates after they have been properly spaced.

Ted Hilger, Andale, Kansas

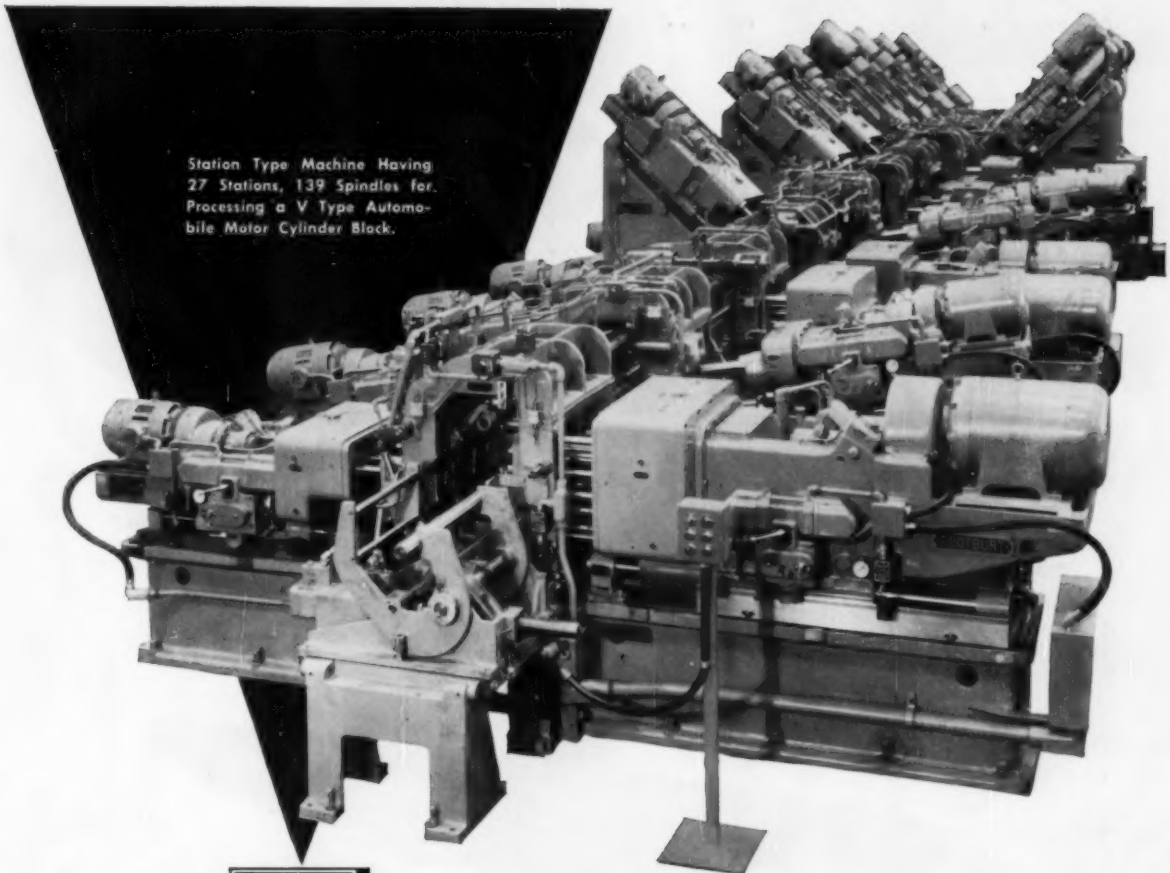


Short Wrench Saves Time

When a vise is positioned lengthwise with the milling-machine table, a standard wrench can only rotate about ¾ of a revolution. Should it then become necessary to open the vise wide when you are in a hurry, shifting the wrench every ¾ turn can be very annoying.

The photo shows a wrench we have modified to eliminate this handicap. It was cut off about 1 in. short of hitting the table. A hole was drilled and fitted with a piece of suitable rod to make a handle. It works in opening or closing the vise, but to tighten or loosen a workpiece the regular wrench is used.

J C Magee, Schenectady, NY



Station Type Machine Having 27 Stations, 139 Spindles for Processing a V Type Automobile Motor Cylinder Block.

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Drilling, reaming, tapping, milling, checking and testing may be combined in one station type machine, and units may be mounted at any angle.

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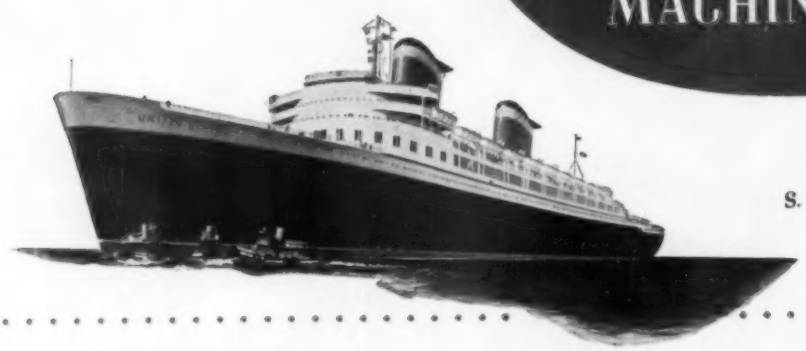
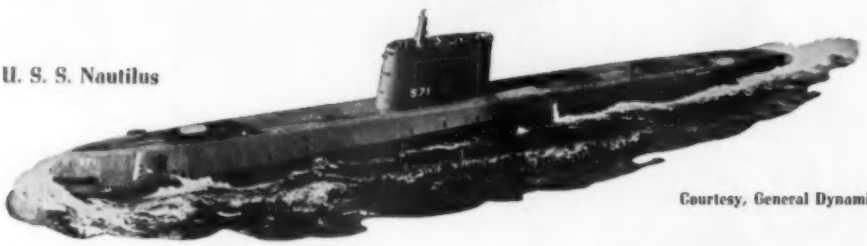


S. S. United States

U. S. S. Nautilus



Courtesy, General Dynamics Corporation

U. S. S. Forrestal

Red Ring horizontal rotary shaving machines were used by Westinghouse Electric Corporation to finish the main propulsion gears of these great ships and many others.

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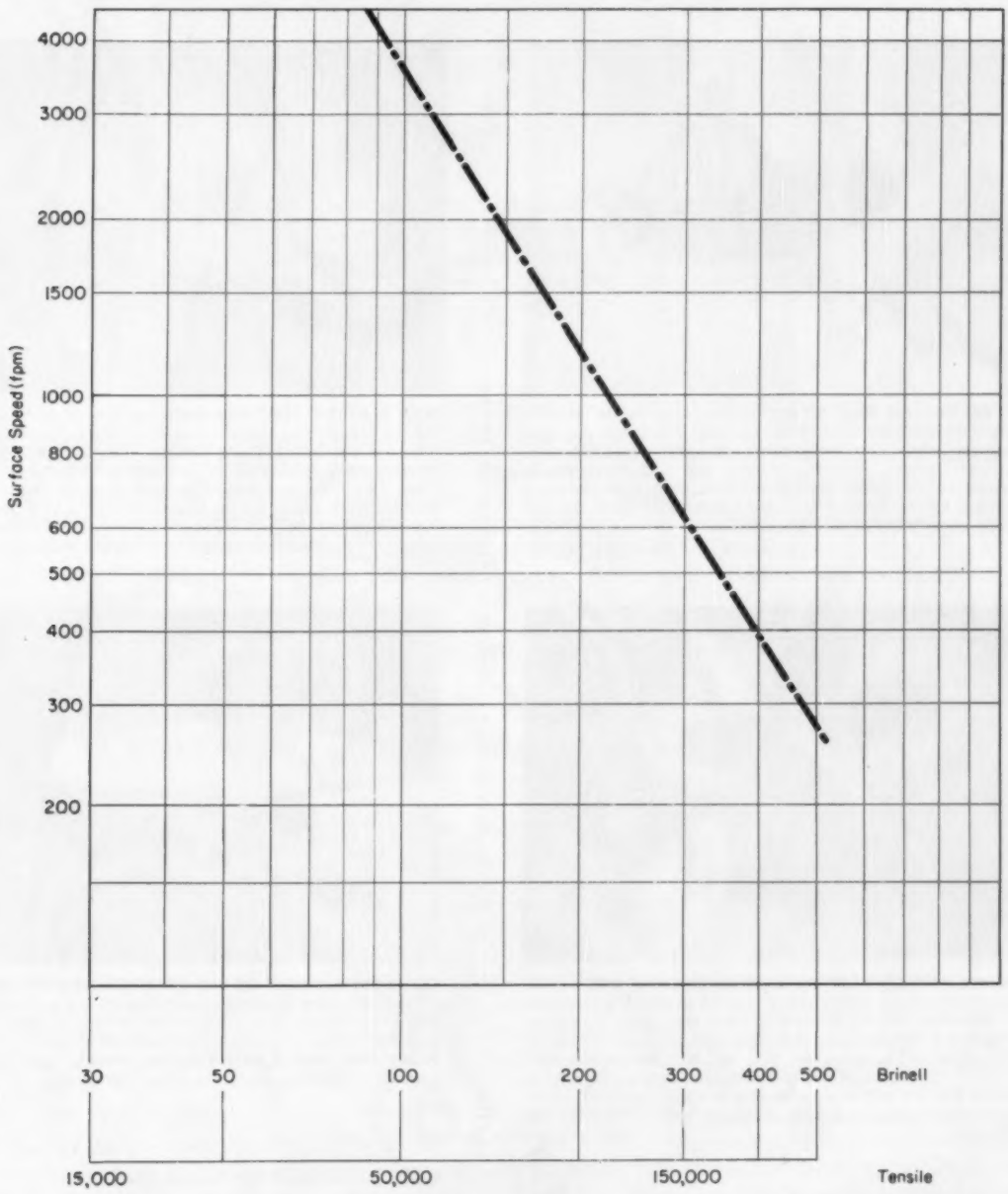
WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

Cutting speeds for oxide tools

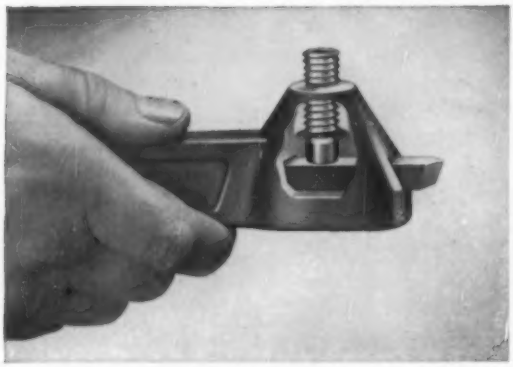
Courtesy Monarch Machine Tool Co, Sidney, Ohio



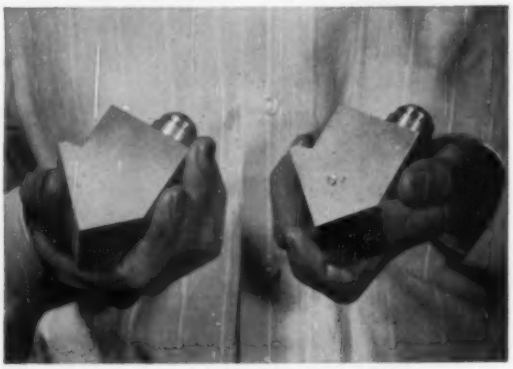
This chart, which shows the relationship between Brinell hardness of the work and appropriate cutting speed for oxide tools, may be used for finish turning plain-carbon, alloy and heat-treated steels. Depths of cut should be held below 0.100 in. for annealed materials and 0.032 in. for heat-treated materials. Feed rates should range between 0.0025 to 0.009 ipr. No coolant should be used. Machine and setup should be free of vibration. Best results are obtained with negative-rake ceramic tools. Cutting speeds suggested should result in about 1-hr. tool life.

Practical Tooling Tips

Everyday more and more shops are using standard Vlier Tooling Accessories in place of custom-made devices for both tooling and original equipment applications. The precision construction, product uniformity and quick availability of these simple time-savers have made them tool room favorites. Why don't you start saving from their use?

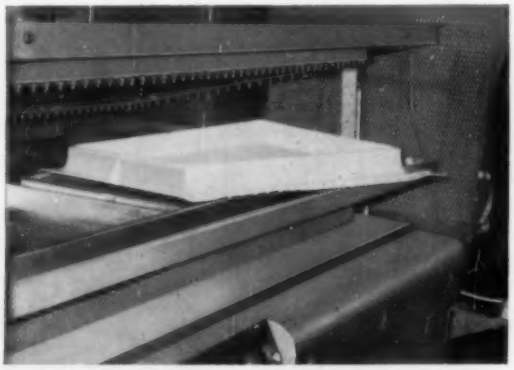


TO GET GREATER TOOL BIT RIGIDITY replace the tool holder screw with a Vlier Swivel-Pad® Clamp. The large, flat pad face provides many times more clamping area. Bits can be held tighter, reducing chatter and vibration. Small, narrow cut-off blades, multipoint tools, even stub ends can be rigidly held. Unique ball joint construction gives smooth angle adjustment in all directions.



EASY WAY TO STOP MARRING surface of part held in fixture. The part on the left was securely held in the fixture with a Vlier Swivel-Pad® Clamp. The scrapped part on the right was held with an ordinary set screw. With the Vlier Swivel-Pad® Clamp the pad stops at first contact with the part; screw torque is absorbed by a ball, preventing damage to the part. This exclusive ball joint construction also provides adjustment to off-angle surfaces.

SPRING PLUNGERS LET WRENCH DO MULTIPLE DUTY—The compression tool shown above is used to attach connectors to electrical wires. Formerly, each size wire connector required a different size tool. But now, through the use of Vlier Spring Plungers, one tool attaches all sizes of connectors—through the use of changeable jaws. The appropriate jaw for any size connector is easily inserted, accurately positioned, and held in place with a Vlier Spring Plunger.



THE RIGHT AMOUNT OF END PRESSURE AND NO MORE is what this spring plunger application calls for. More than 150 Vlier Spring Plungers are used to hold a plastic sheet in position during the forming operation of a plastic refrigerator door liner. Spring Plungers provide just the right amount of pressure to produce a perfect liner.

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Milling with Carbides . . I

JOHN BEGLE, director, Research Dept, FUTURMILL, INC, PONTIAC, MICH

Before taking a trial cut on a milling setup with carbide cutters, all factors in the situation should be reviewed with a standard checklist such as the one presented below. Table II on the next page will give the correct starting speed and feed for any job on any milling machine; and, having made that first cut, a good shop man should be able to make logical adjustments and quickly arrive at the proper *operating* speed and feed for the particular job. Table I is a ready trouble-shooting reference for the more common difficulties experienced in a trial cut.

CHECKLIST

DECIDE WHAT YOU WANT TO DO:

Do you want finish?
Do you want high metal removal?
Or, do you want a combination?

STUDY THE MACHINE:

Was it designed for the kind of work you plan to do?
Is it rigid—no loose gibs, worn ways, or gear or bearing slop?

Does it have enough power to do the job? Become familiar with the nominal rate of metal removal in relation to hp for each material so that, before starting, you can estimate the depth and width of cut possible with your machine.

STUDY THE SETUP:

Is there support under the part?
Will the fixture interfere with chip flow?

Are you milling in the direction indicated by the fixture design—against the stops, not away from them?

Is the fixture strong enough for carbide milling? Because carbide machining is usually done at relatively high speeds, the pressures exerted on the workpiece are great, and heavy, rugged fixtures are essential. A flimsy fixture that allows vibrations to be set up within the work is a mortal enemy of carbide and should be rebuilt or replaced before use.

SELECT THE STARTING SPEED:

Note in Table II that the materials have been grouped into five categories, with a single starting speed for each:

200 sfm for hard or high-temperature materials,

300 sfm for high-abrasive materials,

500 sfm for CI and medium steels,

800 sfm for mild steels,

900-up sfm for non-ferrous materials.

Familiarize yourself with these speed groupings, and you will be able to select your initial speed setting with new confidence. Experience has led us to believe that the higher speeds for ceramics will be more critical than the ones presently employed with carbides. However, for carbides, these five speeds will be suitable, especially for the trial cut. Adjustment can be made later for most economical tool life on the particular job.

SELECT THE STARTING FEED:

Here we do not have the same neat groupings that we had for speed, but are guided by the following general principles:

Chip load goes down as hardness increases, except for some of the work-hardening materials, where high chip will undercut the hardened surface, and the newer high-temperature materials, where high chip will reduce heat generation.

Abrasive materials and "gummy" materials demand a heavy chip load.

Roughing takes high chip load.

Finishing takes low chip load.

Wear on carbide is induced by speed rather than feed.

DURING THE FIRST CUT:

Cutter:
Is it riding the chips?
Is it sparking?
Is it slowing down in the cut?

Chips:
Are they well-formed?
Where are they falling?
What color?

Work, fixture and machine:
Is there vibration?
Is there excessive heat?

Listen—The smooth sound of the cutting action tells a story which has a meaning for any good machinist. Machining is still an art, and a good man will rely on his ear.

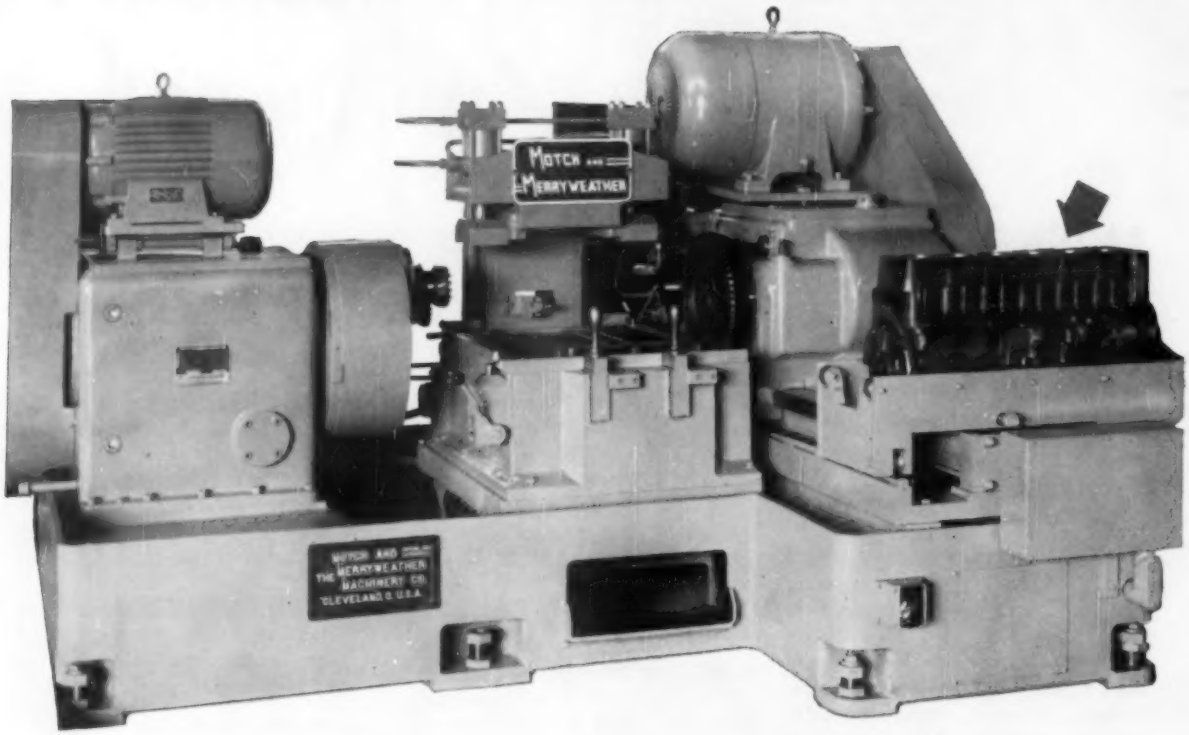
AFTER THE TRIAL CUT:

Adjust the speed and feed. Reduce each one only if absolutely necessary. Go up if conditions indicate or if the first cut seemed *good enough*. Keep going up in speed and feed until you run into trouble and then back down enough to leave a margin of safety.

Reinforce the fixture if necessary. Use jacks, angle plates, lock nuts, wedges, etc where needed to eliminate any fixture weakness observed during the cut.

Organize in your mind, or on

M&M develops another specialized machine



Special Duplex Milling Machine

more than doubles milling production on cylinder blocks

A prominent automotive manufacturer—comparing this M&M machine with previous equipment used to mill ends of cylinder blocks—reports:

In addition to boosting production from 22 to 50 blocks per hour, this M&M machine has greater strength in planetary milling unit, gives longer cutter life and more accuracy. Its extreme rigidity permits rough and finish operations in one pass of the heads.

An operator positions the block in the fixture where it is automatically clamped. The right hand head feeds across one end of the block while the left hand planetary head profiles the flywheel housing mounting surface. Cutters rapid traverse back, fixture is unclamped and finished block is removed.

Machine Tool Manufacturing Division

MOTCH AND MERRYWEATHER

Cleveland, Ohio

Milling with Carbides . . II

paper, the errors observed during the cut and work out your solution for each one. Correct the most obvious errors first, leaving the less serious ones for subsequent cuts.

Table I shows a variety of troubles as they are evidenced in the cutting tool. You will find, in the left-hand vertical column, the variables over which you have control. Reading across the top, you will find a column for each of the most common troubles you will encounter in carbide machining.

By reading down in the column under the trouble, you will find those variables which are factors of the trouble. For example, if you found excessive land wear after the first cut, your chart would tell you that land wear is a factor of speed but is not a factor of feed. You would then correct the speed (reduce it) until the land wear became normal.

One word of caution—correct for only one variable at a time and one trouble at a time. If your trouble shooting is to be at all systematic, you must tackle the most obvious trouble first and then work on the next until all your problems are solved.

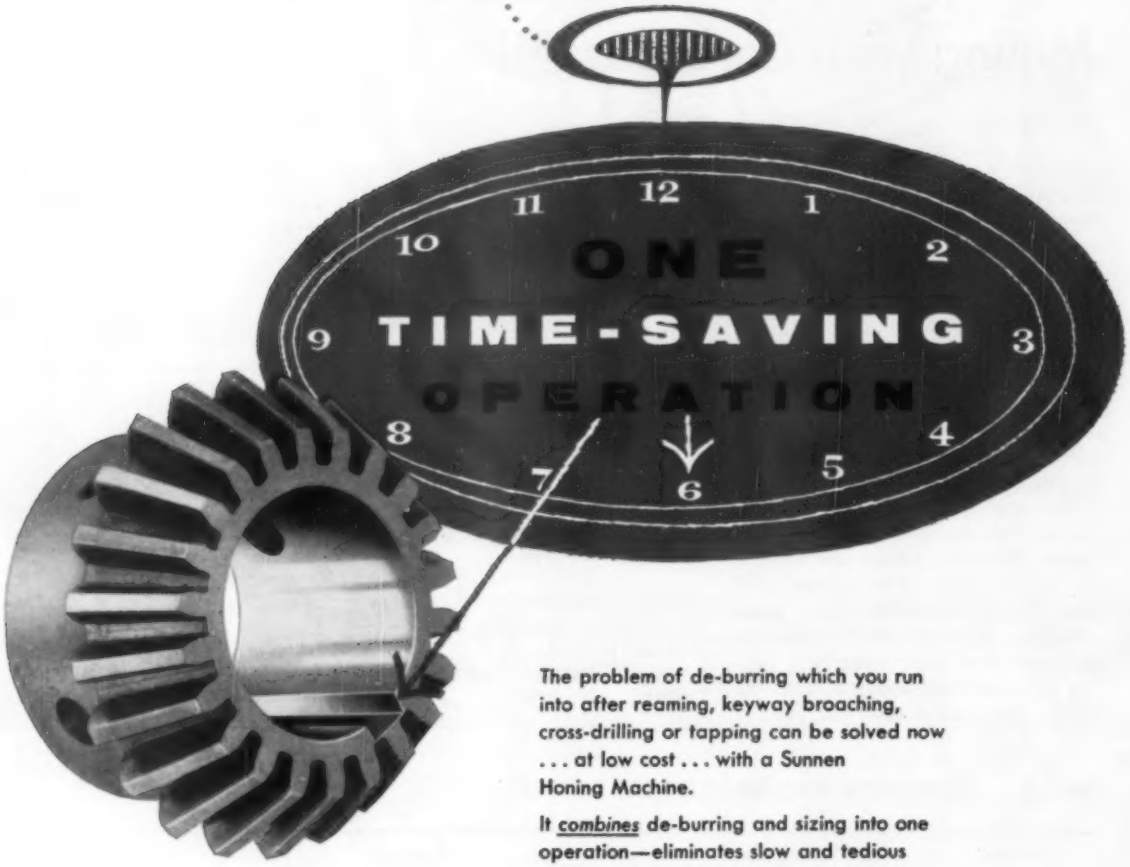
table 1 . . TROUBLE-SHOOTING CHART

Variables	Description of Trouble				
	Blade Breakage	Edge Chipping	Excessive Land Wear	Cratering	Built-up edge
Speed	.....	too high	too high	too high	too low
Feed	too coarse	too coarse	.....	too coarse	too fine
Setup	not rigid	vibration	vibration (disintegration)	.....	.....
Machine	Insufficient hp (stalling)	vibration	.....	.....	.....
Material	.....	hard	abrasive	abrasive	"gummy" or hard
Coolant	Intermittent	.....	insufficient	insufficient	.....

table II . . RECOMMENDED STARTING SPEEDS AND FEEDS

Material	Speed Range (sfm)	Starting Speed	Feed Range (ipt)	Starting Feed	Carbide Grade
High Alloys	150 - 300	200	0.003-0.008	0.004	Steel
Meehanite	200 - 350	300	0.005-0.015	0.008	Cast Iron
Stainless Steel 300 series	200 - 350	300	0.005-0.008	0.006	Cast Iron
Cast Iron - hard	200 - 350	300	0.006-0.020	0.010	Cast Iron
Steel - high carbon	200 - 350	300	0.004-0.007	0.005	Steel
Stainless Steel 400 series	400 - 650	500	0.006-0.012	0.008	Steel
Cast Iron - soft	400 - 650	500	0.006-0.025	0.012	Cast Iron
Malleable Iron	400 - 650	500	0.006-0.025	0.010	Cast Iron
Cast Steel	400 - 650	500	0.005-0.020	0.008	Steel
Steel - med carbon	400 - 650	500	0.005-0.010	0.006	Steel
Steel - low carbon	700 - 950	800	0.005-0.020	0.008	Steel
Beryllium Copper	700 - 950	800	0.006-0.015	0.008	Cast Iron
Non-metallic:					
Hard Rubber, Plastics, etc	800 - 1000	900	0.010-0.015	0.010	Cast Iron
Copper and Copper alloys	800 - 1000	900	0.008-0.015	0.010	Cast Iron
Aluminum	1000 - up	max	0.008-0.020	0.012	Cast Iron

de-burr and size bores in . . .



The problem of de-burring which you run into after reaming, keyway broaching, cross-drilling or tapping can be solved now . . . at low cost . . . with a Sunnen Honing Machine.

It *combines* de-burring and sizing into one operation—eliminates slow and tedious de-burring operations and additional material handling.

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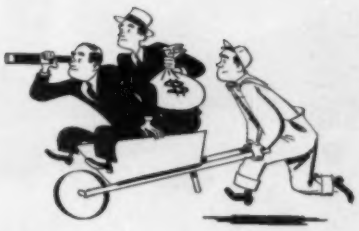


Road Business

We've been studying a report turned out by a computer on the impact on industry of the $50 billion road-building program. The average annual business for the next 13 years is estimated at $14.8 million for machine tools, $16.7 million for cutting tools, and $308 million for construction machinery. Other estimates are $22 million for metal stampings, $2.8 million for electric welding, and $11.6 million for iron and steel forgings. The computer is located at the Computer Services Division of the Council for Economic and Industry Research, Inc. One of the most fascinating and inexplicable facts produced is that the road-building program will result in an increase of $800,000 per year in the production of alcoholic beverages. The computer doesn't say why.

Butt Joint

At the Hanford, Washington, plutonium plant operated by General Electric for the AEC, a method has been developed to butt weld stainless steel without the addition of filler metal. W R Smith and L C Lemon devised the method: Edges are machined so there is a raised edge on the near side and a slight bevel on the far side. The raised edges provide the metal required to fill the joint. The weld is made by the inert-gas tungsten-arc process. It seems that the joint preparation provides a weld bead in which the surface tension forces overcome the gravitational forces in all positions of welding.

Stretched Plastic

STRETCH FORMING of acrylic plastics is more than just a way to form parts. The Bureau of Standards has found that the tendency of these clear plastic to "craze" is greatly reduced by stretching them. Tensile strength and toughness are both increased remarkably by stretching. The amount of stretch that is possible varies with the brand and grade, but generally runs from 50 to 150%.

Hand Seamwelder

A PORTABLE SEAMWELDER that can be used on car bodies is reported from Czechoslovakia. The welding head is about 20 in. in diameter and can be suspended from a portable-tool hanger. Required cooling water, power, and driving power for the rollers all are supplied from a fixed location nearby (the driving power through a flexible shaft). The head can seam weld plates with a total thickness of about 0.09 in.

More R & D

ACCORDING TO Witty Consultants, New York firm of management counselors, the Federal government is spending $2.7 billion of tax revenue on basic and applied research—12% more than last year—and the percentage is expected to go higher. At present, 57% of all the scientists and engineers in the aircraft industry are in research and development.

Aero Trend

HAVE YOU THOUGHT about what the missile is doing to the aircraft industry? With the prospects that in a few years half of military aircraft output will have been switched to missiles, there is a major shift called for in the production approach.

For one thing, the chances are that we will have a relatively few missile designs with rather large production of each. The result may not rival the auto industry in quantity, but it will be a lot closer to mass production than anything yet found in aircraft plants.

At the same time that the aircraft people are adjusting to this new outlook, the auto builders seem to be moving the other way. Several hundred different combinations of options are possible on some of the major cars and such a basic item as the engine is available in several different forms. Evidence mounts that buyers prefer this choice and the builders are learning how to live with the new problems created.

We don't suggest that the two industries are changing places, but the differences in their production methods are less every year.

Porous Metal

THE FIBER METALLURGY technique developed at Armour Institute of Technology has led to a porous metal sheet at SOS Co. The continuous sintered sheet of felted metal fibers can be varied over a wide range of porosities and is reported to have high strength. Possible applications being investigated include high temperature filters for aircraft engines and honeycomb fill for tail sections.

Bargain?

If your aim in life has always been to retire to a small engine factory in Austria, now you have your chance. The Austrian government is going to auction off the Rotax Works, A. G., of Wels, Upper Austria. It is a former German asset taken over by the state and now to be disposed of because the Austrians don't favor much nationalization. Rotax has 300 employees and builds engines for scooters, bicycles, and motorcycles.

See Less Defense Business for Metalworking in Changing Aerial Weapons Product Mix...

By 1961—50% Planes and 50%

WASHINGTON—The major shift in the product mix of aerial weapons that has taken place over the last six years, and which will be accelerated to the point where plane and missile output will run 50-50 by 1961, is going to have a decided effect on aircraft metalworking.

As the trend toward missiles steps up, the numbers of different weapons systems in effect will be fewer, and volume production of each will be much smaller than the rate of output for more conventional aircraft.

The impact of all this on metalworking industries will be great. Companies which have depended on high-volume production—like tool and die shops and airframe makers and their major suppliers who are not diversifying into missile work, and producers of spar and skin mills and other heavy machine tools will be seriously hurt by the transition.

Switchover Has Been Fast

Back in 1952, only 3% of Congressional appropriations for production of aerial weapons was earmarked for guided missiles. Right now the percentage is up to 28. In future years, the trend will speed up even more, so that by 1961 funds for missiles and planes will run about 50-50. Assuming no important changes in world affairs, the outlook is for a combined plane-missile dollar volume production just about the same as it is now—in the neighborhood of $7.8 billion.

Annual sums for missile production have jumped from $468 million in fiscal 1952 to about $2.5 billion for fiscal 1958, are expected to rise even more in the near future. Appropriations for piloted planes have averaged about $6.3 billion annually for the past three years, are now slated to drop in upcoming years as the transition to missiles speeds up.

A startling factor about these figures is this: though missile spending is already heavy and increasing rapidly (the value of deliveries will rise from $1.5 billion this year to $2 billion in fiscal 1958), only 10 different missiles (many of them relatively primitive in nature) are now operational—that is, are in the hands of service units ready for use tomorrow should war break out.

No Volume ICBM Yet

Volume production of the more sophisticated and costly missiles—like long-range ballistic missiles—is still not at hand. These are still in the development stage: only selected subsystems and prototype models of the end-item are being turned out.

The era of total pushbutton warfare is still a long way off; military men stress that missiles are still in their infancy—"The state of the art is not much past the stage of the wire-braced biplane," says one.

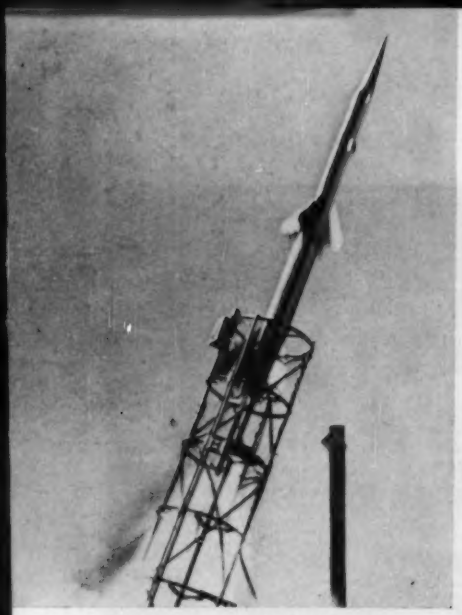
But guided missiles have already taken over many types of tactical and air defense missions from manned aircraft—and even more from conventional guns. The Air Force is dropping three manned fighter-bomber wings and one light bomber wing from its Tactical Air Command because of increasing missile capability. The Army is replacing conventional anti-aircraft guns with missiles, is setting up missile-armed atomic support commands to provide long-range artillery fire. The Navy now has 18 missile-equipped carriers, cruisers, and submarines at sea, is rapidly converting and building other vessels to carry a wide range of missiles.

Shifts in Procurement Policy

In the wake of these developments, defense producers have experienced some serious shifts in military procurement policy:

First has been the development of the "weapons-system" concept of procurement, under which the role of the airframe maker—and other prime contractors—has become more free-wheeling. Until the development of missiles, and supersonic manned planes, the airframe maker was mainly an assembler—putting together the engine, bombing and navigation system, fire control, and the like (all separately developed) which the government supplied.

Now he's called a "weapons system contractor," with more centralized management chores. He has the responsibility for designing and developing specially-tailored components and subsystems for the high-performance missile or supersonic plane, to make sure of each part's dynamic compatibility. No longer can such products, developed and produced by others, be taken off the



Missiles?

shelf and cranked into a new end-item. As a result, there's been a tendency for the prime contractor to keep more work in his own shop and to subcontract less to other firms.

Military Contractor Reshuffle

Second has been the shakeup of companies in the roster of leading military contractors. For the most part, the established giants of airframe-making lead the pack in missile production. But they do so mainly because they've diversified into production of guidance, control, and propulsion systems. Some old-line airframe makers who haven't diversified are being shoved to the side, and new blue-chip industrial firms are developing—notably in electronics, which makes up about 50% of the missile dollar (compared to about 25% in the most advanced planes), and in rocket engines.

Now producing rocket engines and other new types of powerplants are such established airframe makers as North American Aviation, Bell Aircraft, Fairchild Engine & Airplane Corp, McDonnell Aircraft, and Ryan Aeronautical.

North American, Convair, Lockheed, Northrop, and Fairchild have diversified into missile electronics, competing with established producers like Sperry-Rand, RCA, Westinghouse, Raytheon, Hughes, Philco, General Electric, and Western Electric. Rocket engine producers like Thiokol, Aerojet-General, Marquardt, Grand Central Rocket, and Reaction Motors—little known or non-existent until recently—have knocked off hundreds of millions in defense contracts.

In electronics, scores of small new firms have blossomed forth as important money-makers (Ramo-Wooldridge, Servomechanisms Inc, Kearfott, Topp Industries and the like) and almost as many established producers in metalworking and other industries who have moved in (examples: Rheem, American Machine & Foundry, GM's A-C Sparkplug Division, Goodyear, ACF Industries).

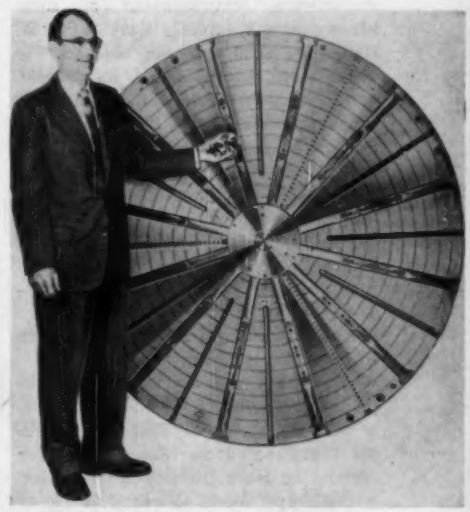
Impact Yet to Be Felt

But the significant impact of the missile transition is still to come. In a recent Washington speech, the Air Force's Major General David H Baker, Procurement and Production Director of the Air Materiel Command, warned that "the company and industry composition of (defense production) may shift radically unless each participating member recognizes what is happening and adapts and adjusts to the changing requirements for his future role."

Baker's theme was that there are fewer weapons systems and fewer prime contractors in the cards:

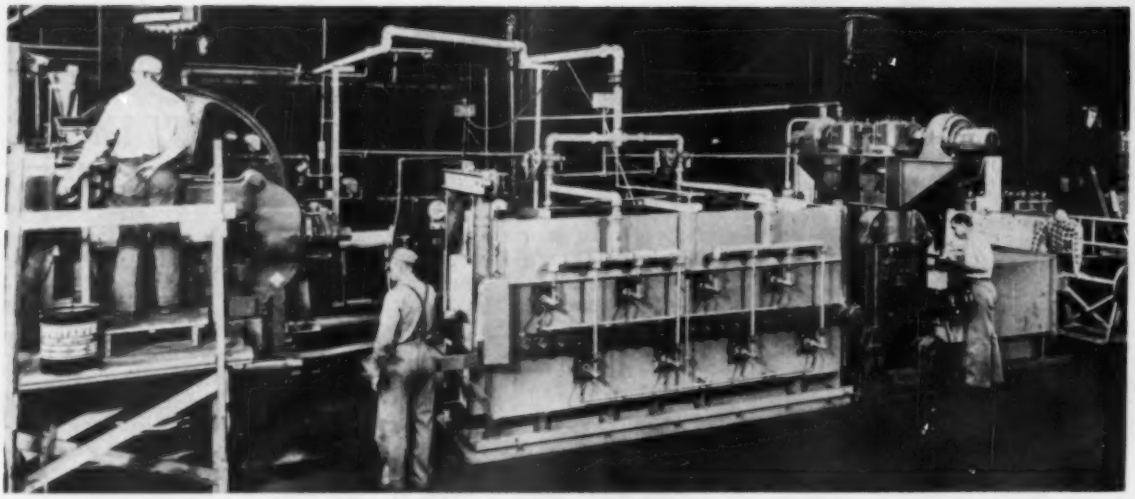
- Numerical requirements for strategic air weapons have been sharply cut because of the greater destructive power of nuclear explosives. As a result, there's more emphasis on superior performance of the delivery vehicles.
- Future output of manned combat planes is declining. "Because of the influence of cost of increasing complexity, we must have major advances in performance to justify replacement of inventory aircraft . . . adding significantly to our striking or defensive power."
- Current production of air weapons amounts to 5-million lb of airframes and missile frames monthly. Early next year, a temporary peak of 6.5-million lb will be reached. But from then on, there'll be a downslide, dropping to 2.5-million lb by 1962. (Peak Korean aircraft production hit 11-million lb monthly.)
- As missile production speeds up, big decisions will have to be made as to whether to build new plants or to use idle aircraft plants. Air Force producers now use only 40-million sq ft out of some 60-million sq ft available. Over the next two years, 10-million sq ft of specialized new facilities will be built—for final checkout, testing, and firing of missiles and rocket engines. By this time, however, only 20-million sq ft of plant space will be in use and 50-million sq ft idle. Many existing facilities can be converted for missile work. But the question remains whether the conversion costs would be cheaper than new facilities.
- "It must be recognized that as total volume of work declines in the prime contractor's plants, there will be strong motivation . . . to restrict the offsite production under his control." Right now, about 30% of airframe and missile frame production is subcontracted. "Since the products involved in this . . . are of the primes' own engineering and design, their manufacture is generally compatible with the primes' production capacity."

Baker's words gave substance to vague fears which have long beset aircraft producers and their suppliers. The implication is clear that companies which have depended on high-volume production—tool and die shops and other types of metalworking producers—as the spur for defense business will be hurt by the transition from large numbers of manned planes to a smaller quantity of guided missiles.



Biggest Lathe Chuck?

This J-type chuck, 66 in. in diameter, is claimed by its manufacturer, Horton Chuck Division of Greenfield Tap & Die Corp, Windsor Locks, Conn, to be the largest of its kind. It will be used for machining jet engine components. Controlled centering pressure device permits centering of large thin-walled rings and other jet engine parts without distortion



Revolutionary Process . . .
Metal strip, tubing and other products can be fabricated directly from metal powders at a saving of about 80% of conventional melting and rolling costs. Thus, copper strip might be priced slightly over 30 cents per pound, instead of 48 cents. Process can be applied to copper, nickel, titanium, ferrous metals, alloys of these metals, and admixtures of alloys and oxides to produce materials with special properties. Experimental line shows: left—compacting rolls, center—sintering furnace, right—hot-mill rolls, a fraction of customary mill equipment

E. W. Bliss: Century Mark Is Jump-Off

CANTON, OHIO—After 100 years of experience, development of new ideas seems relatively easy for E W Bliss Co. Now that the company is celebrating the start of its second century, let's take a look at new ideas just unveiled:

- Strip from powder metal.
- "Turnkey" plants.
- Electronically controlled, electromagnetic press drive.
- Land-based steam catapults for aircraft.
- High-speed cold extrusion of metal parts.

And awaiting development are some more ideas:

- Inclinable presses running at 3600 strokes per minute.
- Automated press lines, wherein all standard press accessories are controlled from the new press drive
- Dial-type feeds to carry work to presses arranged in a circle.
- An increase in explosion stamping.

Such concepts are a far cry from those in existence when Eliphalet W Bliss worked as a journeyman machinist in a Connecticut press-building plant. But the company founder did very well nevertheless: the rolling mill clutch (1870), the first inclinable press (1878).

One century of E W Bliss Company growth saw a tiny press building shop grow into a company with six divisions and 11 plants in five states, a Canadian subsidiary and operations in France and England. It is expected that annual sales volume will soon reach somewhere in the neighborhood of $100,000,000.

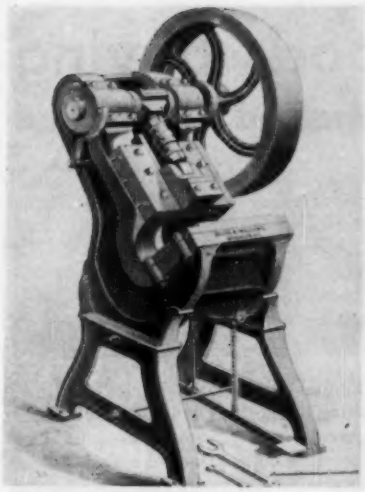
Hot Idea

Of current Bliss developments, the hottest idea is manufacture of strip, tubing and other products from powder metal. So far, only an experimental setup has been made at the Rolling Mill Division, Salem, Ohio, but the process has been proved out. Many suppliers of non-ferrous materials such as copper alloys, titanium, etc have shown interest because of the economic possibilities.

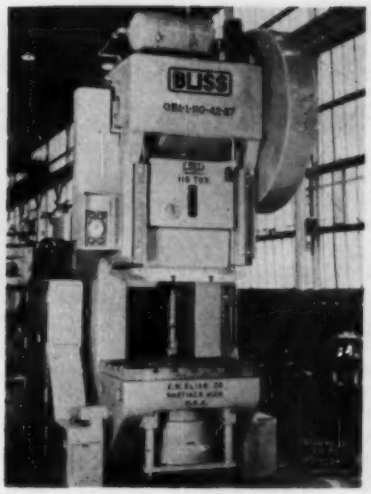
Take copper strip for example. Suppose the basic ingot copper costs about 28¢ per lb. Another 20¢ may be added to costs for melting, pouring ingots, rolling billets, and rerolling into strip. Plant investment is high. By the process Bliss is using, powders are compacted, sintered and hot-rolled, at a saving of 80% of conventional melting and rolling practice. Much less equipment and space are required. Powders are in ample supply, and some of them can be made cheaply from low-grade ores or muds.

As with conventional powder metallurgy, you can mix about any alloy you wish—even add oxides, ceramics, etc, to obtain special properties impossible with melting practice. Resulting strip can have up to 100% density, but much material will not need that much after treatment by rolling. Perhaps half the copper used in this country is for ornamental purposes or low-pressure purposes like radiators, where 100% density is not needed. So Bliss is shooting for contracts to equip plants to make strip or tubing. Perhaps the development will lead to decentralization of manufacture of basic products consumed by the metalworking industry. A large consumer of copper strip, for example, might put in his own powder-metal compacting, sintering and rolling line or encourage another company to set up shop nearby.

Technical advantages of the process to metal consumers are likely. For example, strip so produced does not have grain or directionality properties, as are induced by the strain of many rerollings. Therefore, the die designer may have greater freedom in scrap-strip lay-



When Bliss was young . . .
First inclinable press (1878), "intended to take the place of both an upright and an inclined press, doing work of both with equal facility," was forerunner of 125,000 units



Today . . .
JIC inclinable features completely inclosed design, with all electrical and air controls built into the press. Bliss is largest press builder, makes many styles and sizes

Point for New Ideas

outs for economy of metal usage. Or the drawing properties may be different than those of conventionally made materials. However, these differences presumably are of less importance than ability to make tailor-made alloys with new properties, or to develop new special products.

Your New Plant, Sir

The "turnkey" plant idea, as announced by Robert Potter, president of Bliss, involves building a plant from bottom to top, installing the machinery, training the customer's personnel, and then literally handing the key to the customer and saying "Now it's all yours." This is no idle proposition. It has been done. The first turnkey plant is the new $18 million Cleveland Division of the Jones & Laughlin Steel Co.

Here, Bliss acted as contracting engineer for the entire job—foundations, plant, mills and mill accessories. Much of the equipment was built by Bliss, some was contracted for, and other items were purchased.

Bliss stands ready to apply the turnkey principle in other fields than rolling mills. It will build a complete stamping plant, or a can-making plant. Studies will be made of present costs. A schedule of anticipated costs will be drawn up for operating the new facility, as well as for the actual cost of the equipped facility itself. In doing this work, Bliss will work with established consulting engineers, and will also draw upon the experience of executives and engineers in its divisions.

The electronically controlled, electromagnetic press drive permits two-speed operation—fast advance to the work, and controlled slower drawing speed. A pressure limitor can be added to prevent die breakage. The press can be operated faster than one with conventional drive. In one case, a contract stamping manufacturer estimates he can save the cost of the press in one year because of more strokes per minute.

Navy fighters and bombers are launched from carriers by Bliss-built steam catapults. Now, Bliss is working on barriers and arresting gear for land-based military and commercial aircraft. The idea of a catapult-equipped commercial airport is not thought too far-fetched.

Development work is going on with respect to forging machines to make compression fittings and the like. The details remain secret, but the machine is of a type that has proved itself on hot forgings.

Business "Plateau" Ahead, Industrial Suppliers Told

SAN FRANCISCO—Business activity will "plateau" in the months ahead, Dallas banker Ben H Wooten predicted in a talk on "The Financial Picture Today" before the Triple Industrial Supply Convention at the Mark Hopkins here June 17-20.

Several factors, he said, can be used as business barometers today:

- High-grade utility bonds are selling at highest yield in 25 years.
- Confidence in business is demonstrated by an advance in prices of stocks and in plant expansion programs.
- Construction outlays in May ran to $4 billion—a May record.
- Annual starting rate for new homes is running at 990,000 units.
- Retail sales in May were 1% ahead of April, 4% ahead of May '56.
- Wholesale prices are advancing.
- Employment is at 65.2 million.
- Farm prices are climbing.

Said banker Wooten: "Every study indicates there is enough supporting economic force to offset the weak spots, and we have no reason during 1957 to expect anything more than a leveling off of major indexes. . . . Remember, in our great plant expansion program, inventories are the breeding grounds of recession."

The Wooten talk highlighted the joint annual convention of three groups: Southern Industrial Distributors Association, National Industrial Distributors Association, and American Supply & Machinery Manufacturers Association. Meeting was attended by 2000.

Feature of the meeting was a talk on cost accounting by Ralph M Johnson and William H Perks of the Norton Co, who discussed findings resulting from product profitability studies of three Norton distributors. It was found that it is a bad idea to drop an unprofitable product unless it is replaced by another, or other products are expanded to make use of released capital, manpower and facilities.

Given merit awards for "selling the product first, then the distributors' services" were: L S Starrett Co, Henry G Thompson & Son Co, Simonds Abrasive Co, Illinois Tool Works, Simonds Saw & Steel Co, Dodge Mfg Co, Republic Steel, and B F Goodrich Industrial Products.

Pentagon Slashes Hard Goods Buying

$ Billions in Procurement to Be Canceled, Postponed

WASHINGTON—The Defense Dept is revamping spending plans for military hardware in the new fiscal year. The cancellation or indefinite postponement of billions of dollars worth of procurement is in the works.

This is what's at issue: the skyrocketing (and unanticipated) level of military expenditures—almost all in the Air Force—threatens to wipe out the slim federal budget surplus and break through the statutory debt limit. Defense Dept spending for fiscal 1957, now ending, will hit some $38.5 billion—at least $2.5 billion over the original estimate. At the current rate, fiscal 1958 expenditures will come to at least $40 billion if unchecked, not the $38-billion estimate set when the administration's budget went to Congress for approval in January.

So the Pentagon has been ordered to clamp down hard. Says one Defense Dept official: "There'll be a lot of new faces around here next year if we spend $40 billion." This is what's happening:

- A spending ceiling of about $38 billion has been set. Each service is now studying what to do to stay within its authorized chunk of this sum—cancel procurement orders, hold back contract awards, reduce manpower, trim operating and maintenance costs, or whatever.
- Defense Secretary Charles E Wilson will then set priorities for projects within each service and between them. This could very well mean, for instance, that he might order the Army to cancel a truck contract to save money to keep a priority Air Force bomber project going.

Pentagon officials say it will take months before final details are worked out. But important preliminary decisions must be made within the next few weeks if any real hold-down on spending over the next 12 months is to be put into effect.

To hold down on its spending, the Air Force has already put into effect wide-sweeping production cutbacks: Boeing's B-52 and KC-135, output reduced from 20 to 15 monthly; Lockheed's F-104 fighter, down from 34 monthly; Republic's F-105, from 20 to 16; Convair's F-106, peak output of 23 monthly delayed five months; Douglas' C-133 transport, from two to one per month; Cessna's T-37 jet trainer, peak output of 27 monthly delayed six months; an improved model of Boeing's Bomarc missile has been cancelled, and the total program cut; Martin's Matador missile, from 22 to 14 a month; Hughes' Falcon missile from 400 to 300 a month.

On a Defense Dept level, Wilson has ordered that:

- Contract awards across the board amounting to $500 million (to be let this month) must be held back. This will delay, but not necessarily kill, the contracts for several months, and thus postpone deliveries—and Treasury cash outlays—originally set for fiscal 1958. It will also put the damper on the free-wheeling contracting, common at the end of a fiscal year as procurement agencies rush to use up authorized funds still not committed to contracts.
- Overtime for contractors and Civil Service employes must be restricted. Pentagon officials admit this was mainly a stab in the dark; they're not sure how much money will be saved.

Spending Outdistances Budget

Military spending is running over the budget estimates—partly for these reasons: (1) cash outlays for contracts let within the past two years are being made earlier than planned because of shorter lead times in aircraft development; (2) the crash program for ballistic missiles is taking increasing amounts from production funds (see page 122); (3) industrial price and wage hikes are being passed on by contractors.

But Pentagon budget experts lay most of the blame at the Air Force's feet for what they call "partially funding" procurement programs—that is, starting production projects before enough authorized funds have been allocated by Wilson's office to back them up.

To keep partial-funded procurement in check, Wilson has issued a controversial directive which bans contracts for delivery of planes and other hard goods until enough spending authority has been granted to pay for final delivery of completed items. He also ordered the services to earmark all unobligated funds to cover outstanding projects not already fully-financed, before using the money for new programs.

Air Force Secretary James H Douglas says that a "strict interpretation" of this order—which does provide for exceptions—plus the spending ceiling would mean that in fiscal 1959 the Air Force could place orders only for Boeing's B-52 heavy bomber and KC-135 jet tanker, only one model interceptor and one type of fighter-bomber, the Hughes Falcon air-to-air missile, one drone and decoy missile, and the intercontinental ballistic missiles.

This is the sort of thing the Pentagon budget officials object to:

Suppose the Air Force gets $800 million to buy bombers. It commits only $500 million in its contract with the producers to cover most of the costs. But instead of keeping the remaining $300 million in reserve for the next year for follow-up contracts for modifications and the like, the Air Force commits this money to start work on another producer's new fighter plane.

Pentagon budget people say that as a result of all this, Air Force expenditures "mature" sooner than expected, that spending figures are therefore pushed well over the total budget estimates, which do not include partially-funded projects.

The Air Force is allowed to buy "pre-production" items — machine tools, facilities, and certain long lead-time components—before the basic production contract is let and adequate funds to back up the total project become available. Defense Comptroller W J McNeil claims, however, that the Air Force has also been ordering end-items under "pre-production" procurement.

The Air Force counters these charges with the argument that when a new weapon is successfully developed it wants to hurry into production as fast as possible with available money to reduce lead-times, rather than "sterilize" and build up heavy unobligated balances.

Assembling Isetta automobiles under Italian license at Sao Paulo's Romi-Isetta works

Sao Paulo: Latin America's "Detroit"

Already: 950 Auto Plants, a Budding Tool Industry

SAO PAULO, BRAZIL (Special from McGraw-Hill World News) — The Brazilian government's demand for 120,000 cars and trucks per year by 1961 to fill this country's needs has made this city a mecca for automakers from the United States and Europe. Giants like America's GM, Ford and Willys, and Europe's Volkswagen and Mercedes-Benz are numbered among the more than 950 auto, truck and parts plants that have given Sao Paulo its new title, "The Detroit of Latin America."

Brazilian metalworking was loafing along in low gear until that country decided in 1953 to become an auto and truck producer. Then everybody wanted to get into the act, with foreign automakers and parts makers pouring capital into Sao Paulo and environs, and with local firms scrambling for foreign licensing arrangements or financial backing.

Result today is that more than 85% of Brazil's 5000 metalworking plants (some of them hole-in-the-wall, back-alley shops) and its 300,000 metalworking employees are to be found in and around Sao Paulo, which is often called Brazil's industrial workhorse. Specifically, here are some of the automaking giants that have agreed to produce vehicles in the Sao Paulo area under an agreement with the government to use more than 90% local parts by 1961:

• **Ford**—will offer three kinds of trucks at a total output of 30,000 units per year. Recently, Ford spent $16 million to add an engine foundry to existing assembly plant. Also planned by Ford: local crankshaft production, employing a special casting process.

• **General Motors**—plans to produce 29,000 medium-sized trucks a year, will spend $10 million on an engine plant out on the Sao Paulo-Rio highway, already has an assembly plant in Sao Paulo.

• **Willys**—expects to turn out 800 Jeeps a month, will use more than 250 local factories as parts suppliers. By next year, Willys will have invested $5 million, will have its foundry in operation.

• **DKW-Auto Union**—This utility wagon is being made under license by Brazil's Vemag, which is spending $2 million on new equipment to achieve 10,000-units-a-year output.

• **Volkswagen**—is just finishing a new assembly plant, will spend $3.5 million on new equipment, expects 9000 unit output a year.

• **Fabrica Nacional de Motores**—is making diesel trucks under license to Italy's Alfa Romeo, expects to spend $6.5 million for new equipment to make 7200 trucks a year.

• **Mercedes-Benz**—had the first Brazilian plant to make trucks with locally-cast engine blocks last year. Mercedes will invest $8.6 million on new plant, plans to turn out 9200 medium diesels a year.

• **International Harvester**—is assembling trucks and farm equipment and is setting up its own foundry. I-H will spend $6 million to reach output of 6000 trucks a year.

Other firms planning to move into the Sao Paulo area but not yet officially in include Mack (12-ton diesel trucks), Krupp of Germany (heavy diesel trucks), and Britain's Landrover.

From all this planned investment (and those are only the major companies setting up in the Sao Paulo area), it is obvious that Brazil will be a heavy buyer of capital goods over the next few years.

Metalworking Boom

Because of Brazil's requirement that all vehicles contain 90% locally made parts, the auto and truck makers have been combing local metalworking shops in Sao Paulo to line up parts makers. Hundreds of shops are already in the act, and some heavy foundry work, too, is being done in Sao Paulo. This has, of course, given rise to a fantastic growth in metalworking. Here are some of Sao Paulo's shops that have made deals with foreign firms:

• Metal Leve S A makes Germany's Mahle pistons for nearly all the truck makers—European, local, and American.

• Maquinas York makes gears under license to America's Republic.

• COFAP makes Monroe stabilizers (U S), Thompson brake linings (U S), and Perfect Circle (U S) piston rings.

• Vibar makes Hastings (U S) piston rings, and Albraus S A makes Spicer axle equipment.

• D F Vasconcellos has already turned out its first made-in-Brazil

SAO PAULO (continued)

Bendix carburetor, while Plasticos do Brasil makes Delbestos-Bendix brake linings.

- Fabrica Nacional de Vagoes makes chassis and disks, and will make wheel components under Firestone and Goodyear licenses.
- Cobrasma is being licensed by Timken to make axle and differential parts.
- Borg & Beck do Brasil makes Borg-Warner gear disks. Bimetal makes Clevite Corp white bearings. Standard Motors S A makes valves and other parts under license from England's Standard Motors Ltd.
- Robert Bosch do Brasil makes Bosch injection pumps; Ferodo S A manufactures Italy's Ferodo brake linings; and Brassinter S A makes lubrication parts and systems under license from U S Graphite.

. . . and more licensing agreements are being born every week.

But when an item is made in Brazil, that cuts it out as an import and it must be scratched off the lists of exports from the U S. Even so, Brazil needs axles, roller bearings (Timken is looking into this), dashboard instruments, differentials, transmissions, gear boxes.

Bert Keller, an American who has lived in Brazil for 20 years, represents South Bend lathes, Du-More grinders, Jacobs chucks, and Skil tools. He claims that because of import restrictions, local shops prefer to buy standard equipment from Brazilian or mid-European firms, even though they would prefer an American machine. Until recently, American tools were often 10 times the price of others because of the rate of import exchange.

Recently, the exchange value of American tools has been cut in half so that today you see some U S equipment coming in. But U S machine tool and metalworking equipment builders will have to go into production of standard tools in Brazil itself if they want to make a dent in the market, Keller says.

Local machine shops are running to get aboard the auto bandwagon. Shops that once turned out only one or two items will today touch only production runs of 1000 to 10,000 pieces. Consequently, because Brazilian shops are woefully underequipped, there's a large market for production machine tools.

Lathe output at Sao Paulo . . .
Romi-Isetta, which also manufactures autos, turns out 2000 lathes a year

Foreign Parts Makers Move In

Aside from the automakers themselves, many foreign parts manufacturers, mostly American, are coming into Brazil under a law that allows foreign firms to bring in machinery at a free rate of exchange, instead of having to buy special import licenses at 3 to 4 times the price. One way of bringing in equipment cheaply is to merge with existing Brazilian firms.

Brazilians generally are somewhat critical of the comparatively high-handed licensing methods of U S companies, claiming that we don't give all sorts of bonuses to licensees (waiver of initial fees, cutting down on licensing rates, financing) as the Europeans do.

American metalworking firms have an enormous opportunity in Brazil, according to a local auto parts maker, "but they're too preoccupied with deals at home to see what's going on here."

One exception, however: the Norton Co, has joined up with Meyer, a Brazilian firm, to make abrasives. And a few others are drifting into business in Brazil, "but not nearly enough."

In and around Sao Paulo today, you can find almost any kind of metalworking shop, but mostly on a small scale by U S standards. Sao Paulo also has a few machine tool builders of its own: Promeca makes lathes under Belgian license; Maquinas e Equipamentos Itaia makes drills and lathes similar to those of Delta; Maquinas Cruzeiro S A makes metalcutting machines similar to those produced by DoALL; Maquinas Gutman makes 50 heavy presses a month.

All those shops are expanding rapidly, are tooling up for increased production. Too, two big drill factories in Sao Paulo—Tuwill and Metalurgica Paulista—are in the market for machine tools to aid in their expansions.

Sao Paulo machine tool salesmen believe that a current credit squeeze, caused by the Brazilian government trying to cut down on inflation, has dampened first half '57 sales, but they anticipate the automotive industries and their suppliers this fall will spark the biggest machine tool boom in Latin American history. Also listed as potential buyers are makers of appliances, stoves, pumps, farm gear and all sorts of motors.

Sao Paulo businessmen today are so exuberant about their upcoming industrial boom that they predict "made in Brazil" sales tags will soon be seen in the world's export markets. Even now, Brazilian railroad equipment, textile machinery and auto parts are finding markets in Colombia, Chile and Argentina.

But perhaps the best way to illustrate the mushroom growth story of Brazilian metalworking is to take the case of Romi-Isetta—an outfit that is in both automotive and machine tool production.

Romi started back in 1941 as a maker of lathes on a by-U S-standards small scale. Last year, Romi took on license to make Italy's small Isetta cars, importing the engines, but making most of the car in Brazil. The Romi people not only had the foresight to go into auto output, they planned to make machine tools suitable to automobile and parts manufacture.

Today, Romi has four standard types of lathes, purely Brazilian in design, will turn out about 2000 of them this year—plus 1500 Isetta cars—all in the same plant. And Romi-Isetta expects its sales to shoot up at least 400% in the next 2-3 years. Too, the firm is buying more than $1 million worth of machine tools from Cincinnati Milling and from Kearney & Trecker, to be used in turn to make machine tools for Brazil's fast-growing metalworking industries. And next year, Romi-Isetta hopes to come out with automatic lathes, under license from an as-yet-unnamed U S machine tool builder.

South...

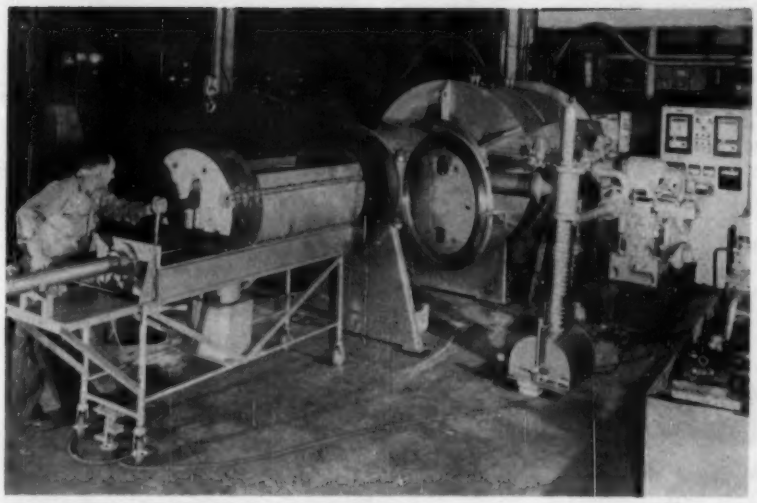
Around the South . . .

Ex-Cell-O Corp, Detroit manufacturer of machine tools and automation equipment, has bought a 30,000-sq-ft plant near Asheville, NC . . . **Metal Products Division** of **Thompson Industries** is moving its headquarters from Indianapolis to Valdosta, Ga . . . Construction of **General Electric's** 135,000-sq-ft appliance motors plant at Murfreesboro, Tenn, will be completed by Dec . . . **Anaconda Wire & Cable Co** plans a 150,000-sq-ft wire and cable manufacturing plant at Watkinsville, Ga, expects it to be in operation in about a year . . . **Rohr Aircraft** is completing expansion at its Winder, Ga, assembly facility; it's added 10,000 sq ft to the plant, will hire another 100 workers . . . First Middle Atlantic States Apprenticeship and Training Conference will be held at the McLure Hotel, Wheeling, W Va, July 16-19. Some 800 representatives of management, labor, vocational education, and government will swap ideas on training methods and trends . . . **Dixie Aluminum Corp** is adding 45,000 sq ft to its fabricated parts plant in Atlanta and upping equipment investment by $300,000 . . . **Tennessee Products & Chemical Corp** is expanding at Rockwood to the tune of $15 million. Eight electric furnaces have been put into operation at the ferro-alloy plant, four others are under construction . . . **Air Control Products Co,** Atlanta, is putting up a 30,000-sq-ft plant to make metal windows and doors . . . **Southwire Co,** Carrollton, Ga, is expanding to increase production of extruded and drawn aluminum and copper wire . . . **Seco, Inc,** Goodlettsville, Tenn, has added new items to its feed grinding equipment line, including light fabricated steel products . . . Warehouse Division of **Atlantic Steel Co** is opening a 14,000-sq-ft branch office and warehouse in Birmingham.

West...

Western notes . . .

Production at **Anaconda Aluminum Co's** Columbia Falls, Mont, plant will be cut back 25% (down to 45,000 tons a year). Reason, says Anaconda: slow sales, high stockpiles . . . **Lockheed Missile Systems,** Sunnyvale, Calif, has a $14.5 million AF contract to continue its ramjet engine flight test program. It'll extend the X-7 test vehicle work through middle of next year . . . Employer groups in two California counties, San Benito and Tehama, have pushed through right-to-work laws outlawing the union shop. State Federation of Labor is fighting the ordinances . . . **North American Aviation's Los Angeles Division** has a **Martin Co** subcontract for construction of ground equipment for the Titan missile. Work will start at once on the transtainer units, used to transport and contain the weapon on the ground . . . **Westinghouse Electric** will design and manufacture experimental seagoing handling and launching systems for Navy's Polaris IRBM. Development of mechanical and electrical systems for launching from surface ships or subs will be centered at the Sunnyvale, Calif, manufacturing division . . . **Precision Castparts'** new $125,000 investment casting and shell molding plant has begun operations in Portland, Ore . . . Steel consumption rate in the seven western states will reach 10 million tons a year by 1965, according to **Kaiser Steel Corp's** President Edgar F Kaiser. Last year's consumption: 6.5 million tons . . . Look for further extension of **Borg-Warner's** west coast manufacturing activities; **Weston Hydraulics, Ltd,** Calif aircraft component subsidiary of **B-W,** has bought 32 acres of land in Van Nuys. Multi-million-dollar expansion of **Weston** is for development and production of hydraulic and pneumatic equipment for aircraft, missiles, and rockets. **Weston** says other **B-W** divisions and subsidiaries may put up facilities on the new site . . . **Ryan Aeronautical Co,** San Diego, says business volume is highest in its history. Sales totaled $30 million for six months ended April 30, up from the $56 million annual rate for the peak wartime year, 1945. Net profit was 16% under first half of last year, though, because of costs involved in new production programs . . . **Boeing Airplane** is altering one of its buildings at Seattle to house a numerically controlled spar mill. And it's putting up a $300,000 test facility at Renton, Wash, for its jet engine sound suppressor-thrust reverser unit. Test site will have two run-up silencers 45 ft long, 12 ft in dia. Engines will



Martin Tries Out Vacuum Brazing

Two horizontal retort vacuum furnaces with movable workholding boats, like the one pictured here, have been shipped by F J Stokes Corp to The Martin Co, Baltimore, for experimental and limited-scale production vacuum brazing of aircraft components. The furnaces, which can also be used for vacuum degasing, annealing and heat treating, work this way: (1) parts are loaded into movable boat, which is driven into 2-zone vacuum chamber (right) by hydraulic ram, (2) door is closed and pressure reduced to about 20 microns or, if necessary, to less than 1 micron, (3) resistance heating elements in chamber's "hot zone" raise temperature to desired level for brazing or heat treating—as high as 2150 F, and (4) after processing, work boat is withdrawn into water-jacketed cooling zone for controlled cooling of work, also under vacuum

FIELD REPORT

be suspended from A frames to exhaust into silencers . . . **Portage Double Quick, Inc,** Cleveland, has opened a west coast office and warehouse in Compton, Calif. It'll carry complete lines of PDQ tools for milling machines and turret lathes . . . **Metals & Controls Corp** of Attleboro, Mass, is opening a west coast facility this month in Los Angeles to expand its technical service to the aircraft and guided missile industries. It will engineer supplementary actuating systems for Klixon miniature precision switches in aeronautical and electronic applications.

Midwest...

Midwest shorts . . .

Year-long manpower survey conducted by the Chicago Association of Commerce and Industry showed that the 559 metropolitan area firms who cooperated in the study hired 141,550 workers (27.7% of their total employment) during 1956. Total community need for the next five years is expected to be at least 100,000 new workers per year . . . **General Electric's** Evendale, Ohio, jet engine plant has a $4-million AF contract to turn out J-79 turbojet engines used to power the B-58 Hustler supersonic bomber . . . **Cross Co,** Detroit producer of automation machinery, has licensed three firms to build the Cross Machine Control Unit, a prime element in automatic tool programming. Licensees: **Scully-Jones & Co,** Chicago; **Seibert & Sons, Inc,** Chenoa, Ill; and **Royal Design & Manufacturing, Inc,** Detroit . . . Twenty internationally manned panels will discuss hot problems in the metals field at the **2nd World Metallurgical Congress** to be held in the Chicago International Amphitheatre Nov 2-8. Gathering, sponsored by the American Society for Metals, will include 650 overseas metal scientists . . . **Republic Steel** has installed a $1.5 million bonderizing and painting unit at its Berger Division plant in Canton, Ohio. Equipment makes Republic the first locker manufacturer to employ five-stage bonderizing for its complete locker assemblies . . . **GM's Allison Division,** Indianapolis, has an Ordnance contract for production of 900 CD-850-5 military transmissions for M48-2 medium tanks . . . 8th annual **National Noise Abatement Symposium** will be held at Chicago's Sherman Hotel Oct 10 and 11. Sponsored by the Armour Research Foundation, plus a group of research and professional organizations, the gathering will quietly pursue the causes and cures of factory and community noise . . . **Surface Combustion Corp,** Toledo, has set up a new Pelletizing Division; it'll engineer and market processing equipment for complete pelletizing plants. License rights were acquired from **Erie Mining Co** . . . **Kaiser Aluminum & Chemical Corp** has ordered an additional 24 railroad gondola cars with all-welded aluminum bodies from **Pullman-Standard Manufacturing Co.**

East...

Eastern newsbriefs . . .

Norton Co is putting up a new $6.5 facility to turn out organic bonded grinding wheels. Plant 8, located on a five-acre site in Worcester, Mass, is designed for straight-line production of wheels up to 30 in. in dia; it'll be completed in mid-1959 . . . **Waltham Watch Co** plans to break up into two separate corporations. Present company would be known as **Waltham Precision Instrument Co,** concentrating on production of mechanical and electronic components and timing devices. New company would then be set up within the renamed firm; it would be known as **Waltham Watch Co of Delaware,** and devote itself to development and marketing of watches and clocks . . . **Continental Bearing Research Corp,** New York, has been organized to provide engineering development and manufacturing services in bearings and lubrication. They're set up to analyze, design, and supply bearings in production or semi-production quantities for specific applications . . . **Bendix Radio Division** of **Bendix Aviation Corp,** Baltimore, has a $2.2-million AF order for development of a new radar set for air traffic control. **General Electric Co's** small aircraft engine department at West Lynn, Mass, will handle a $12.2-million AF contract for product improvement work on the J-85 jet engine . . . **Stromberg-Carlson,** Rochester, NY, division of **General Dynamics Corp,** will need 11,000 employees by next spring, according to **GD** president Frank Pace, Jr. **Stromberg** jobs have climbed from 5000 to 8000 since its merger with **GD** two years ago.

Old Gisholt Lathe to Smithsonian

One of the first lathes manufactured by Gisholt Machine Co, Madison, Wis, this 1889 turret lathe was recently presented to the Smithsonian Institute, Washington, as part of the Institute's permanent exhibit in its new Hall of Tools. Shown at the machine's sendoff to Washington are, from left: G E Gernon, secretary of the company; George M Class, vice president; Alfred G Hoffer, works manager; and R F Johnson, assistant to the president

E C Bullard

E P Bullard III

Names in the News . . .

E C Bullard has been elected chairman of the board and chief executive officer of The Bullard Co, Bridgeport, Conn. **E P Bullard III** has been named to succeed him as president and general manager.

Graduate of Yale's Sheffield Scientific School, E C Bullard has been with Bullard Co since 1917, except for army service in WW I. He became vice president and general manager in 1931, and president and general manager in 1946.

Grandson of Edward Payson Bullard, who founded the company in 1880, and son of E P Bullard Jr, second president of Bullard from 1907 to 1946, E P Bullard III served the company in many capacities from 1933 to 1951, including assistant chief engineer, manufacturing vice president, and vice president and assistant general manager. He was responsible for design of the Cutmaster vertical turret lathe, the Man-Au-Trol vertical turret lathe and spacer, and two improved types of Mult-Au-Matic machines, as well as other Bullard developments. He holds 39 machine tool patents. Since 1951 Mr Bullard has been chief of production engineering for all aircraft manufacturing of Pratt & Whitney Division of United Aircraft Corp. He is a Yale graduate and attended Harvard Business School.

James N Landis, vice president of Bechtel Corp, San Francisco engineering firm, has been named president of the American Society of Mechanical Engineers. He will be installed during the ASME annual meeting to be held in New York in December, and will serve for a term of one year.

Robert N Kendall has been appointed vice president of Colonial Broach & Machine Co, Detroit. Mr Kendall, who has been serving Colonial recently as sales research consultant with headquarters in Washington, DC, was sales engineer for the company in the Detroit area for many years. He will continue to headquarter in Washington.

George S Aradan has been made master mechanic of Chrysler Corp's Stamping Division, and **John H Davis** divisional chief engineer. **Ernest W Marchand** is new manufacturing manager for the Mack Ave (Detroit) plant.

Robert M Briney has been appointed president of Haynes Stellite Co, Division of Union Carbide Corp. He was formerly vice president in charge of wrought alloy products.

James C Mabe, manager of plant operations, Chicago Pneumatic Tool Co, has been elected a vice president. He will be in charge of manufacturing and engineering operations

Bruce E Horst has been appointed sales manager of the Machine Tool Division of Barber-Colman Co. He has been serving as sales representative in the Rockford, Ill, area

Robert F Reid has been appointed sales manager for Arter Grinding Machine Co, Worcester, Mass. He was formerly associated with the machinery sales programs of Gardner Machine Co, Beloit, Wis, division of Landis Tool Co.

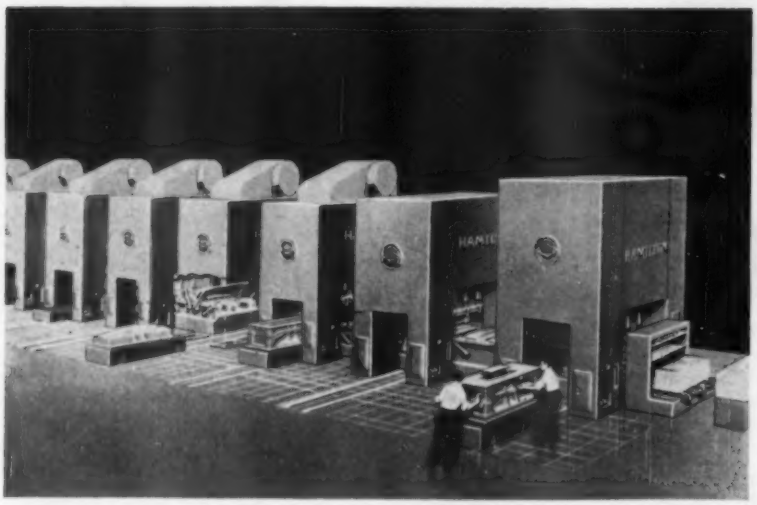
Robert H Morse, Jr, has been elected president and chief executive officer of Fairbanks, Morse & Co. **Gordon R Anderson** is new vice president, engineering. **John C Elmburg** has been promoted from assistant to general sales manager. Reassigned: **Robert H Morse III,** from vice president, sales, to vice president, budgets and planning; **V H Peterson,** from vice president, engineering, to vice president, sales.

George M Class, vice president, engineering of Gisholt Machine Co, has been elected a new general officer of the board of directors.

Obituary

Sir Alfred Herbert, chairman of Alfred Herbert, Ltd, Coventry, England, and world-famed machine tool builder, died May 26 at the age of 90. In his 68 years in business he developed his company from a works employing less than 20 men repairing and making boilers to its present position as one of the world's largest establishments making, importing, and exporting machine tools. Sir Alfred served as deputy director general and later as controller of machine tools in the British Ministry of Munitions in WW I, being honored for these services with the KBE (Knight of the British Empire). He was the first president of the Machine Tool Trades Association (Great Britain).

New Shop Equipment



Hamilton Presses Use Sliding Bolsters and Pre-Set Die

New press design, which is said to increase production by cutting die change time, utilizes sliding bolsters and pre-set dies. The presses were developed primarily for high production on short runs. Design can be used in a single press or in groups and is applicable to all sizes and types of presses—single or double action; top or bottom drive; one, two, or four point.

Sliding bolster reportedly increases production through decreased press die change time. This feature also reduces die set-up time; reduces parts storage requirements; and eliminates necessity of removing automation equipment, placed in front and back, when changing dies.

As little as 5 min need elapse between production runs using different dies. When a press run is completed, die is removed on the sliding bolster. New die, set up on the second sliding bolster during previous run, slides into press for a new production run. Each press has two bolsters independently actuated by pushbuttons which control the motor drive in the press base. The bolsters also can be powered by motor-driven winches. Bolster movement can be independent or simultaneous, as required. Bolsters travel through press sides rather than the fronts or backs—essential for a line of presses, particularly an automated line. In many instances, a sliding-bolster press can give higher production than two presses. Its cost is less than that of two presses and further savings are possible through less need for supervision.

A die change cycle follows this sequence of operations: complete die, including pressure pins, is attached to outboard bolster while production continues on die in press; location of die and pressure pins checked for accuracy; press is stopped, slide run to bottom of stroke; upper punch unclamped from slide; slide run to bottom of stroke. Next, the bolster and die in the press are moved out, and new setup moved in from opposite side; when die is in place, slide is run to bottom of stroke; shut height adjusted, punch clamped to slide; and press is started, ready for new production run.

During die loading, the bolster is completely clear of the press framework. After loading, the bolster partially slides back into the press framework to reduce the amount of floor or aisle space required.

Baldwin-Lima-Hamilton Corp, Hamilton Div, Hamilton, Ohio

Secondary-Operations Turret Lathe Has ⅝-in.-dia Capacity

Cem-Way No. 00 turret lathe, primarily intended for secondary operations, relieves larger machines, eliminating re-setup time and allowing final operations to be performed by unskilled personnel. This is accomplished by the single, synchronized, cam-actuating lever with which the workpiece is locked into position.

Lathe will center, cutoff, spotface, drill, thread, turn, form, chamfer, and pin-point round workpieces up to ⅝ in. in diameter. It can be equipped with a single-speed or a two-speed motor to provide three or six spindle speeds.

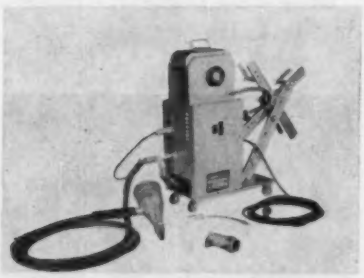
Clark Engineering & Mfg Co, Racine, Wis

Hard-Facing Paste Applies Easily, Deposits Hard Surface

Hard-facing paste, Hi-C 60, can be applied to any metal with a melting point higher than the paste, 1850 F. Material, a permanent suspension of powdered hard-facing alloy in a water-base solution, is applied by spatula, brush, or from a tube. Surfaces treated with Hi-C 60 are reported to have several times the wear resistance of hardened steel surfaces. Thicknesses up to ¼ in. can normally be hardened using gas heat. For thicknesses above ¼ in., induction heating is recommended. Hardness ranges from R_c 55-61. Bulletin available.

Western Carbide Corp, 6840 Vineland Ave, North Hollywood, Calif

Materials and Parts . . .



Semi-Automatic Welding Unit Has Flux and Open-Arc Guns

Semi-automatic submerged arc welding unit of compact and lightweight design is completely equipped with wire reel, caster-mounted base, carrying handles, and all controls and cable necessary for operation on 110v, ac or dc. Two interchangeable welding guns are included—one flux type with hopper, and one open arc type for fluxless welding.

Unit is designed for use with any arc welder having continuous current up to 500 amps, using solid 5/64 or 3/32-in. wires, and 3/32 or 7/64-in. tubular wires—with either gun, depending on the job.

Hobart Brothers Co, Troy, Ohio

Contour Mills Are Now Available In A Complete Line

Hydro-Cycle contour mills are now available in a complete line, either as complete machines or as contour milling units for "building-block" erection. Hand control of the tracer stylus attachment is said to offer a true feel of the work so that irregular contours can be cut without complex equipment. Micrometer adjustments accurately control desired relationship between master and workpiece. Tracer attachment can be furnished with single-dimensional (depth), 2-dimensional (360°), or 3-D control.

Machines use an 18-in. cross travel and a vertical travel of 12 in. Units are also available with travels of 32, 42, and 48 in.; other dimensions and travels can also be supplied. Spindle speeds are infinitely adjustable in the range of 40 to 3000 rpm.

Colonial Broach & Machine Co, Colonial-Romulus Div, Parkgrove Station, Detroit 5, Mich

Two-Station Worktable Is Designed For Induction Heating

Self-contained, 2-station worktable is designed for hardening, brazing, annealing, and soft-soldering operations. Standard units are equipped with 220/440, 3-phase motor generators available in ratings from 7½ to 30kw. Worktable has an output of 220v, 10kc, single phase.

Table comes completely equipped with volt, amp, kva and kw meters. Lights indicate "heat on" and "generator on." Also included is an open-sight drain for visual check of cooling water for generator, capacitors, transformers, and work coils. Dimensions are 40 in. wide x 56 in. long with an over-all height of 63 in. Work area has a height of 40 in.

Welduction Corp, 10230 Capital Ave, Detroit 37, Mich

...including

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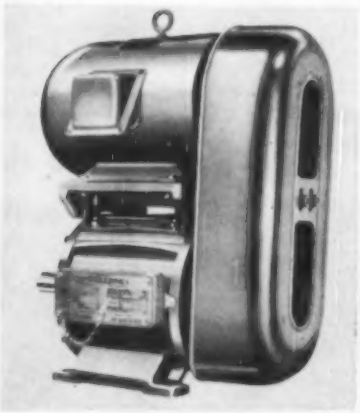
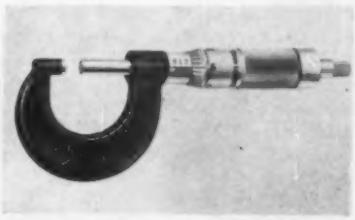


All Cyclic Functions of Machine Are Controlled by Cycledyne Unit

Cycledyne line of standardized power transmission components consists of a series of start-stop power drives and control devices. Each Cycledyne provides all cyclic operational functions for a machine—starting, stopping, inching, positioning, holding, accelerating, decelerating, and torque limiting. During the power drive phase of each cycle the unit serves as a power transmission—with no slippage loss. A continuously running electric motor provides the power.

Machine functions may be controlled by various types of remote switching devices, either manual or automatic, and a choice of numerous sequencing circuits will provide any extent of automation desired. There are five basic size Cycledynes; all are available with foot, flange or face mounting fixtures. There are also open, splash-proof, and totally enclosed options. Foot-mounted, open fan-cooled model is shown above with integrally assembled motor base and input-end belt guard. Altogether, over 200 combinations are possible with these versatile units.

Cycledynamics, Inc, 19025 W Davison Detroit 23, Mich



Lowcost B&S Micrometer Calipers Have Tool-Steel Measuring Faces

Line of 12 new Black-Frame micrometers features tool-steel measuring faces instead of the more expensive carbide. These tools are recommended for work where extra-long life under abrasive measuring conditions is not required. They have a range of 0-1, 1-2, and 2-3 in. by 0.001 in., and are available with or without clamp ring in both plain and ratchet-stop styles. Prices run from $13.45 to $18.75. Bulletin M51 available.

Brown & Sharpe Mfg Co, Providence, RI

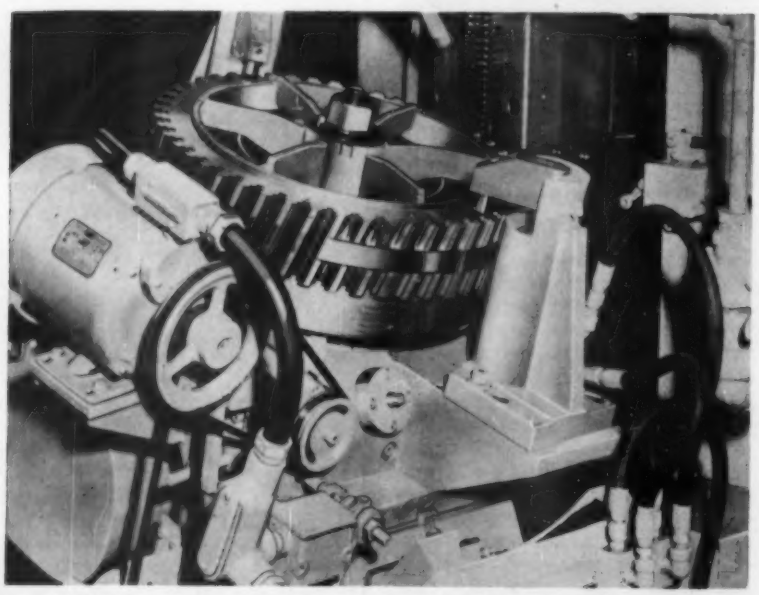
Magnetic Tool Locates Hidden Holes in Structural Parts

Device called Blindriller consists of a sensing tube housing a jewel-mounted pointer tipped with a magnet and mounted in a frame. A small magnet of opposite polarity is inserted in the hole in the structural member from the opposite side after it has been covered by the overlapping structure. When pointer is placed on outside skin and moved slowly over the surface, the pointer seeks the hidden magnet.

Slide arrangement supports both the pointer and a drill bushing. Once hole is located, slide is shifted to left as far as it will go and the drill bushing is brought into drilling position.

Device, developed and licensed by Boeing Airplane Co, is designed to have max error of 0.005 in. in hole location, and is said to be useful in locating broken taps and reproducing templets. It sells for approximately $150.

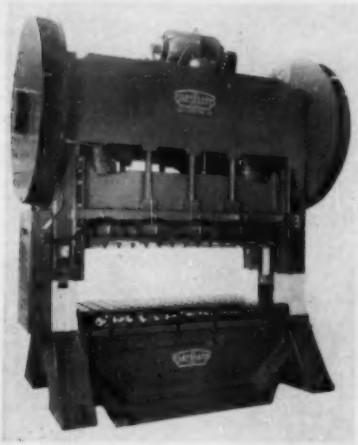
E L Swart Co, Seattle, Wash



INDEXING TABLE for positive parts positioning is available in diameters of 11, 18, and 28 in.; all offer an infinitely adjustable range of index from 21 to 250 div of a circle. Table provides positive index to tenths, no backlash, mechanical self-locking, angular setting (by cradle mounting), and high flexibility—*Colonial Broach & Machine Co, PO Box 37, Harper Station, Detroit 13, Mich*

Vibration pad, designated Tiger Paw, is molded from reinforced fiber glass and vinyl resin, and is said to withstand oil, soap, water, fungus, and chemicals. Designed with suction cups molded into both surfaces, pad holds machinery to floor without use of adhesives. Material is available in 22 x 22-in. sheets or cut to proper machine foot size.

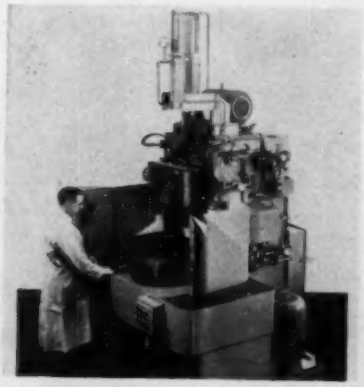
Bullard Clark Co, E H Jacobs Northern Div, Danielson, Conn



200-Ton Press Has Twin Drive, Is Recommended for Heavy Work

Cleveland 200-ton, single-geared, double-crank, straight-sided press is equipped with twin drive and an electrically controlled heavy-duty friction clutch with air brake. Flywheel has auxiliary air brake to enable quick stop when power is suddenly shut off. Press has an 8-in. stroke, 10-in. adjustment of slide, shut height of 30 in., slide or plunger face of 48 x 96 in., and a 33 x 81-in. bed opening. Other straight-sided, double-crank presses are available with capacities from 75 to 350 tons.

Cleveland Punch & Shear Works Co, 3917 St Clair Ave, Cleveland 14, Ohio

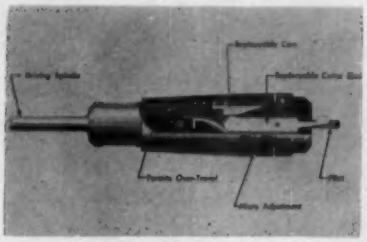


Single-Station Machine Turns, Bores, Faces, and Grinds

BL-1 series of single-station machines perform the following operations: contour turning, boring, and facing; straight boring; surface grinding; surface honing; ID and OD grinding; contour milling; straight or horizontal milling. Machines are available in single or double-spindle models and with single, multiple, or variable spindle speed drives; all machines use interchangeable cam-actuated heads. Cross-slide travel is 5 in.; longitudinal slide travel is 6 in.

Other features include rapid slide traverse during idle time, vertical spindles for easy loading, accessible tool area, generous chip space, and optional high-lift slides for loading of extra-large pieces. Motor drives from 3 to 20 hp per spindle are available.

New Britain Machine Co, Hoern & Dilts Div, Saginaw, Mich

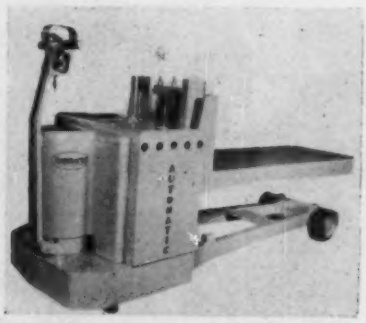


Reverse-Surface Countersink Tool Uses Interchangeable Cutters

Reverse surface countersink tool, designated BakSink, can also be used for some back-forming and grooving operations. Designed to offer micro-set accuracy within close tolerances, tool is completely adaptable for production use, as it requires no specialized equipment, spindle, or work-head, and cuts on forward feed only.

Interchangeable cutters and pilots allow for a wide range of forms and hole sizes within reasonable limits.

Cogsdill Tool Products, Inc, 12980 West 8 Mile Rd, Oak Park 37, Mich

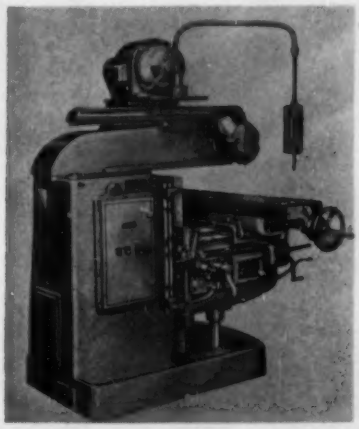


Walkie-Type Industrial Trucks Lift 4000 and 6000-lb Loads

Hi-Skid Transporter Models WWHY-4 and 6 and WWLY-4 and 6 platform walkie-type lift trucks are designed to transport loads of 4000 and 6000 lb. In the WWLY and WWHY-4 the capacity range is 4000 lb up to 54 in. of platform length while in the WWLY and WWHY-6 it is 6000 lb up to 48 in. of platform length. The platform is 6½ in. in the lowered position in the WWLY models and gives a lift of 20 in.; platform of the WWHY models is 11 in. in lowered position and raises loads up to 24½ in.

Trucks have been redesigned throughout to achieve maximum stability through even distribution of weight.

Automatic Transportation Co, Div of Yale & Towne Mfg Co, 149 W 87 St, Chicago 20, Ill



Van Norman Milling Machine Features Adjustable Cutter Head

Model 28A ram-type milling machine features company's adjustable cutter head which allows one machine, without attachments, to perform horizontal, vertical, and angular milling. Machine has 12 speeds, ranging from 40 to 1600 rpm, a cross travel of 14 in., longitudinal travel of 28 in., and a vertical travel of 21¼ in. Max vertical distance between spindle and table is 16½ in.; between spindle and column, 22 in. Table measures 58 x 13 in.

Van Norman Milling Machine Co. Springfield, Mass

Carbide-tipped cutoff tools are available with shanks made of "No-Chat," a new metal which is reported to reduce tool vibration as much as 50%. Greater heat conductivity permits cooler running and longer life. Tools are available in nine standard sizes from 3½ to 6 in. and in various tip widths.

Wendt-Sonis Co, Hannibal, Mo

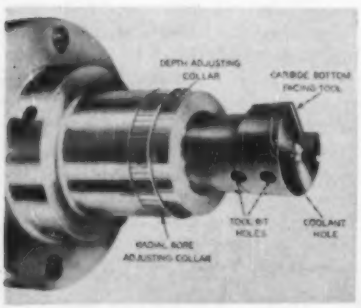
Electronic Control System Performs Automatic Gaging, Sizing, Sorting

Rapid automatic gaging, sorting, or size control is accomplished with electronic control system consisting of company's Model 100 displacement transmitter and Model 562 limit controller. Electronic null-balance system gives high speed and accuracy of 0.00001 in.

With transmitter mounted in gaging fixture, limit points or tolerance values are pre-set on digital dials. Controller reacts in 0.05 sec and positions output relays which can be used to actuate reject or marking devices, sorting gates, or alarms.

System is adaptable to machine tool control to produce parts of predetermined size. Inputs can be programmed from punched cards or other data storage devices. Standard model provides two independently adjustable set points, each with over-under indicator lamps and output relay. Ten or more set points can be provided on special order. Price $675 including cables.

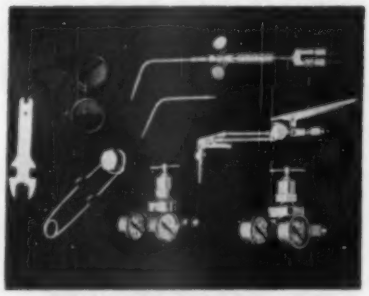
Daytronic Corp, 216 S Main St, Dayton 2, Ohio



Boring Head Has Adjustment For Bore and Depth Control

Boring head combining positive bore and depth control utilizes patented principle which allows adjustment of the boring tool to a tolerance of 0.0001 in. without loosening or tightening any screws. Adjustment is made by turning the calibrated collars with a spanner wrench. A bushing is mounted on pre-loaded balls between the flange unit and the boring bar. Hole in this bushing is slightly eccentric with its outside diameter. This eccentricity provides the over-all adjusting range for controlling the bore size. Catalog 6B.

Briney Mfg Co, P O Box 2208, Pontiac, Mich

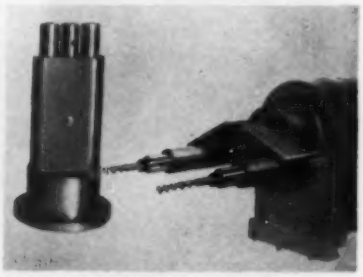


Airco Welding and Cutting Outfit Is Designed for Light-Duty Use

Designed for performance in the light-to-medium range, outfit is designed to handle welding, brazing, heating, and cutting operations. It will weld metals up to 3/16 in. thick, or up to 5/16 in. if larger tips are used, and cut steel plate up to 1 in. thick.

Outfit consists of two style 8000 single-stage regulators, twin 3/16-in. gas hoses with connections, style 400 lightweight welding torch with a mixer and two tips, and the style 1490 cutting attachment with one tip. When assembled for cutting, combined weight of torch anud attachment is only 19 oz; over-all length is 12½ in. Wrench, sparklighter, and goggles round out the outfit.

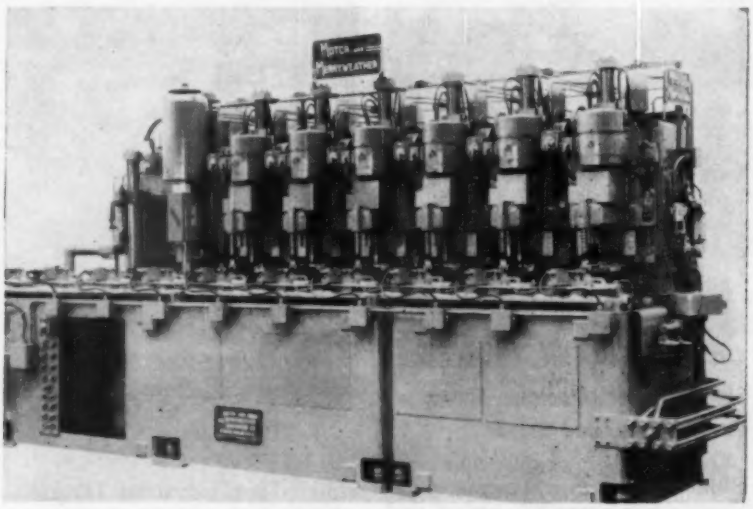
Air Reduction Co, Inc, 150 E 42 St, New York 17, NY



Centers of 2-Spindle Boring Head Are Adjustable from 1 to 6 in.

Type 126 2-spindle boring head (right) has centers which are adjustable from 1 to 6 in. It will fit company's horizontal borers as well as replace all present adjustable heads. Drills turn at motor speed. Other head available (left) features 3 spindles on exact 1-in. centers for drilling dowel holes to government specifications. Both units have hardened steel gears and aircraft-type ball bearings.

Indiana Foundry, Machine & Supply, Inc, Brazil, Ind



AUTOMOTIVE PISTONS are drilled, reamed, and milled on 11-station inline transfer machine. Station-to-station transfer is accomplished by hydraulically operated transfer fingers and a reciprocating transfer bar. Machine is capable of automatically machining 650 piston per hr at 100% efficiency—*Motch & Merryweather Co, 888 E 70th St, Cleveland, Ohio*

FYI

FOR YOUR INFORMATION

FREE Catalogs, Booklets, Charts, Calculators

FYI—these initials symbolize information that's important. And there is much of importance in the literature listed here. To get the ones you need, all you do is fill out one coupon for each booklet you wish to order. Indicate in the circle on the coupon the number of one catalog wanted. When you have filled out a card, detach, stamp, and mail. We'll do the rest.

MACHINES AND ATTACHMENTS

1 VERTICAL TURRET LATHE — *Giddings & Lewis Machine Tool Co, Kaukauna, Wis.* 24-page catalog VTL-3 illustrates and describes features of line of 32, 42, and 52-in. units, with electric clutch controlled coaxial planetary transmission that permits shifting feed on the fly and changing speeds in the cut. Optional equipment includes the first system of tape-automated numerical control.

2 FLYING PRESS—*Wean Equipment Corp, 22300 Lakeland Blvd, Cleveland 17, Ohio.* 8-page brochure discusses features. Examples of production illustrated and described; specifications of line from 20-800 tons in tabular form.

3 SPECIAL MACHINES — *Standard-Modern Tool Co Ltd, 69 Montcalm Ave, Toronto 10, Canada.* Series of six bulletins covers special purpose units that are also adaptable to production applications other than those specifically described. Included are bearing pre-load and torque testing unit; automatic forming and welding machine; multi-station transfer machines.

4 DIAGONAL SHAVING MACHINES —*National Broach & Machine Co, 5600 S Jean Ave, Detroit 13, Mich.* 4-page illustrated bulletin S-57-2 discusses the Red Ring Universal process and basic features of Model GCU 8, 12, and 18-in. units.

5 GRINDING WHEEL DRESSER — *Threadwell Tap & Die Co, Greenfield, Mass.* 4-page illustrated bulletin describes the Tangi-Matic. Contains explanation of use, and specifications, as well as details on design features.

6 TURRET PUNCH PRESSES — *Wiedemann Machine Co, 526 Wissahickon Ave, Philadelphia 32, Penna.* 6-page bulletin 600 TR gives details on units for short run piercing of component parts for trucks and related equipment.

TOOLS AND ACCESSORIES

7 PUNCHES AND PERFORATORS —*Durable Punch & Die Co, 9030 S Hermitage Ave, Chicago 20, Ill.* 120-page manual illustrates more than 100 detailed die designs. Offers solution to punch breakage, outlines an advanced technique of die design to overcome common breakage.

8 TOOL LUBRICANTS AND GRINDING COOLANTS — *Van Straaten Chemical Co, 630 W Washington St, Chicago 6, Ill.* 12-page brochure gives pointers on how to select cutting compounds, cutting speeds and their effect on lubricant selection. Section on grinding coolants tells how wheel form, area of contact, and grit size affect selection.

9 SPECIALIZED TOOLS—*Walton Co, Box 5, Elmwood Branch, Hartford 10, Conn.* Illustrated bulletin presents information on line of tap extractors and extensions; toolholders; and pipe, stud and screw extractors. Sizes, specifications, applications, ordering information, prices included.

10 TOOLS—*Armstrong Bros Tool Co, 5200 W Armstrong Ave, Chicago 30, Ill.* 120-page general catalog lists 4980 tools for industry, including 500 new types and sizes. Covers complete line of wrenches, socket wrenches, drop forged clamps, toolholders, setup and hold-down tools.

11 GRINDING WHEEL CUTTERS—*Koebel Diamond Tool Co, 9456 Grinnel, Detroit 13, Mich.* Bulletin LO-5709 is first of series of progress reports on permanent form control of grinding wheels using cutters of cemented diamond particles. Process, co-developed by Koebel and Jones & Lamson Machine Co, permits complete automation of grinders, eliminates time out for wheel dressing. Schematic drawings illustrate principle involved; installations on J&L grinders pictured.

● DECIMAL EQUIVALENT CHART AND CALENDAR—*Dayton Rogers Manufacturing Co, 2324-13th Ave South, Minneapolis 7, Minn.* Combination chart and calendar (dated July 1 '57 to June 30 '58) is available. Request direct on company letterhead.

12 MOLYKOTE LUBRICANTS—*Alpha Molykote Corp, 65 Harvard Ave, Stamford, Conn.* 16-page bulletin 110 discusses advantages and characteristics of products. Properties, carriers, temp range,

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FYI
FOR YOUR INFORMATION

applications of concentrates in paste form, grease film and dry film lubrication, and dispersions listed in tabular form. Applications illustrated.

13 DIESETS—*Superior Steel Products Corp, 2754 S 19th St, Milwaukee, Wis.* 28-page catalog illustrates and describes features of standard 2-pin sets, 2 and 4-pin rectangular sets, custom made sets. Section gives data on removable cap pins that facilitate parting large and small diesets by eliminating binding. Bolster plates, guide pins, bushings covered.

HEAT TREATING AND WELDING

14 ELECTRIC FURNACES — *C I Hayes, Inc, 800 Wellington Ave, Cranston 10, RI.* Illustrated bulletin 464 discusses features of "Hump-Back" (elevated heating chamber) electrically heated, conveyor-type unit for bright heat treatment of stainless, copper brazing of stainless, micro-brazing, and some high-temp nickel alloy brazing applications. Model is said to be able to handle three to five times production loads of similar units.

15 DIP BRAZING METHOD FOR ALUMINUM—*Handy & Harman of Canada, Ltd, 141 John St, Toronto.* 4-page illustrated bulletin 23 gives data on Alumibraze, new powdered aluminum-silicon alloy applied to the joint in form of paste. Step-by-step details on process included.

16 PUSHER FURNACE — *Ipsen Industries, Inc, 721 S Main St, Rockford, Ill.* 2-page bulletin P-57 describes standard, controlled-atmosphere, multi-zone unit for carburizing, carbo-nitriding, and general heat-treating applications up to 1850 F. Design and construction features, specification table included.

17 FILLERARC AUTOMATIC WELDING EQUIPMENT — *General Electric Co, Schenectady 5, NY.* 4-page illustrated bulletin GEC-1334B contains application information, product features, specifications of equipment for consumable-electrode gas-shielded welding.

18 HEATING ELEMENT ALLOY — *Hoskins Manufacturing Co, 4445 Lawton Ave, Detroit 8, Mich.* 12-page illustrated catalog-manual M-55D presents data on Chromel-D, a 35-20 nickel-chromium-iron product for use in controlled atmosphere furnaces operating at temps up to 1800 F. Includes prices and specifications on alloy supplied in wire, ribbon, and furnace strip form.

PLANT SERVICE EQUIPMENT

19 MOTOR-DRIVEN CONTROLLED VOLUME PUMPS—*Milton Roy Co, 1800 E Mermaid Lane, Philadelphia 18, Penna.* 32-page bulletin 550-1 illustrates and describes complete line of positive displacement units for precise metering and pumping of corrosive liquids against pressure. Accuracy of ± 1% makes them particularly useful as final control elements in proportioning and control systems for blending, formulating, and chemical feeding. Standard and modified models and their applications covered.

20 LIFT TRUCKS — *Yale & Towne Manufacturing Co, Materials Handling Div, 11,000 Roosevelt Blvd, Philadelphia 15, Penna.* 16-page bulletin 5230 contains illustrated descriptions of new G-3 Series of 15,000 to 20,000-lb capacity models with "Wide Angle Vision." Operating and engineering features discussed.

21 MATERIALS HANDLING SYSTEMS—*Planet Corp, 1800 Sunset Ave, Lansing, Mich.* 16-page catalog 67A illustrates and describes engineered and automated handling systems. Equipment for bulk and unit materials, automated and special handling machinery pictured.

22 ELECTROPLATING — *Diversey Corp, Metal Industries Dept, 1820 W Roscoe St, Chicago 13, Ill.* 12-page booklet outlines nine ways to cut costs. Lists suggestions on selection of proper compound, use of titrations, tips on rinsing and proper racking.

PARTS AND MATERIALS

23 CORROSION-RESISTANT ALLOYS —*Haynes Stellite Co, Div of Union Carbide Corp, 420 Lexington Ave, New York 17, NY.* 104-page booklet gives data on Hastelloy nickel-base alloys B, C, D, and F. Describes chemical compositions, physical, mechanical, and high-temp properties; includes table of comparative resistance to over 250 corrosives. Separate section covers techniques for forging, cold working, machining, grinding, and welding.

24 BRASS TUBE FITTINGS—*Weatherhead Co, 136 W Washington Blvd, Fort Wayne, Ind.* 48-page catalog lists all sizes and types of brass fittings, including section showing complete line of drain and shut-off cocks. Also covers push-pull controls, complete assembly instructions, data on tubing a system, and tools.

25 CHEMICAL MILLING—*US Chemical Milling Corp, 1700 Rosecrans Ave, Manhattan Beach, Calif.* Design bulletin No. 5 discusses how blueprints that provide all essential information can save money and time in fabrication of tooling, and at every chemical milling manufacturing step. "Blueprints for Parts to be Chemically Milled" applies to parts in aluminum, magnesium, stainless, and titanium.

26 VARIABLE SPEED BELTS — *Worthington Corp, Harrison, NJ.* 8-page bulletin 1640-B1 P contains complete product information. Tables give Worthington-Goodyear belt applicable to various manufacturers' belt part numbers to facilitate re-ordering; listing of V-belt sizes.

27 WROUGHT HIGH-TEMP ALLOYS —*Westinghouse Electric Corp, PO Box 2099, Pittsburgh 30, Penna.* 4-page booklet DB-52-250 lists physical properties, applications, and shape availability of Discaloy, K42B, Refractaloy 26, and Refractaloy 70 alloys.

28 COLUMBIUM AND TANTALUM PRODUCTS—*Shieldalloy Corp, Newfield, NJ.* 4-page booklet describes properties and applications of columbium metal, carbide, and oxide; tantalum metal, carbide, and oxide. Includes complete chemical compositions of various powders of these materials; detailed listing of various grades of products, and applicability to specific needs.

29 SCREW-LOCK INSERTS—*Heli-Coil Corp, Danbury, Conn.* 8-page bulletin 738 covers complete line including new miniature size 4-40 insert. Contains selection tables with thread sizes, insert numbers and sizes, data on drilling, tapping, gaging, and installation. Applications illustrated.

HAYNES Alloys solve *tough* wear and corrosion problems

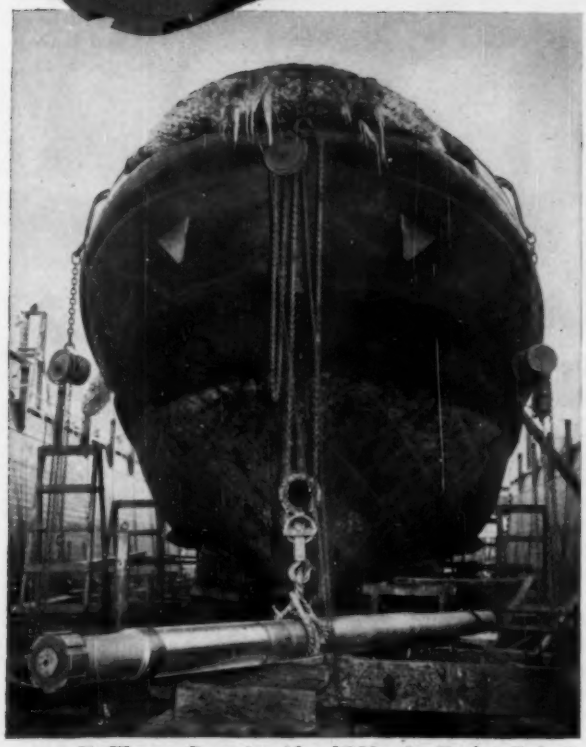
New Method

Eliminates maintenance on bearing area of shafts

After 17 months of grueling service in the sandy salt water of New York's harbor and surrounding waters, a tail shaft sleeved with a HAYNES wrought alloy at the outer bearing area showed only 0.015 in. wear. A bronze sleeve used in this same service wore over ¼ in. in 15 months.

This remarkable improvement in wear resistance was accomplished quickly and economically by the use of half sleeves made of HAYNES STELLITE alloy. Three sets of the half sleeves protected the bearing area of the shaft.

For more information on the many industrial applications for HAYNES STELLITE alloy half sleeves and bushings, ask for a copy of our free booklet. Write HAYNES STELLITE COMPANY, Division of Union Carbide Corporation, General Offices and Works, Kokomo, Indiana.



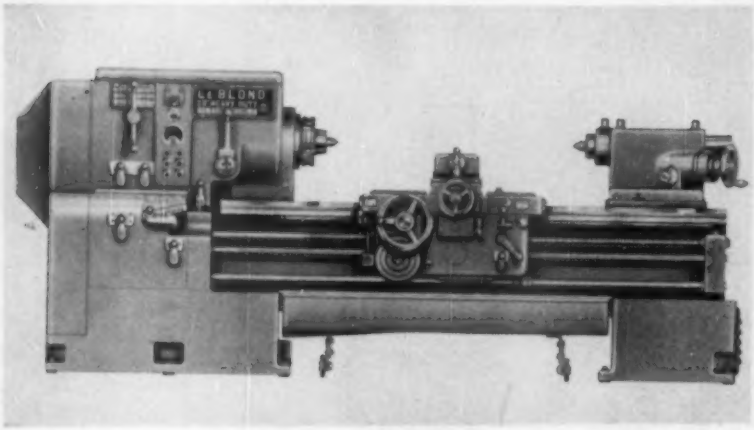
No Wear or Corrosion After 17 Months. Tug's tail shaft is removed for inspection of HAYNES STELLITE alloy sleeves at the outboard bearing area. The sleeved surface still has a mirror-like finish.

HAYNES
ALLOYS

HAYNES STELLITE COMPANY
Division of Union Carbide Corporation
Kokomo, Indiana

UNION CARBIDE

"Haynes," "Haynes Stellite" and "Union Carbide" are trade-marks of Union Carbide Corporation



LeBlond 20-in. Heavy-Duty Lathe Uses Ceramic and Carbide Tools

LeBlond 20-in. lathe is said to be the first designed from the ground up to use 40 hp effectively—it will permit max efficiency with ceramic and carbide tools. Machine has 36 speeds, from 10 to 1300 rpm in geometric progression. Selections are made in fine increments, particularly in the low range. Manufacturer claims there is plenty of power even at low speeds—at 10 rpm a cut can be taken as deep as ½ in. in 16-in.-dia work, feeding at 0.063 ipr. Spindle is supported by five bearings. DC speed selection at apron is available with simplified gearing in head.

In the two-speed tailstock, spindle travel is geared for conventional and low speed. When drilling, for example, the handle is pushed in to drill at slow, powerful feed; handle is pulled out to retract quickly. Tailstock can be moved by power.

Controls are engineered for operator convenience and safety. Speed and feed selection levers are always moved toward operator for increase, away for decrease. Speed selection is color coded. Four-directional power rapid traverse is controlled by a single lever. In addition there is a built-in horsepower meter, a chasing dial integral with the apron, and quick-setting diameter-reading dials on crossfeed.

Other features include hardened and ground replaceable steel bedways with compensating V-way design; automatic lubrication to head, quick-change box, apron, single-shot to tailstock; one-piece apron; and flame-hardened rack. Bulletin HD-143

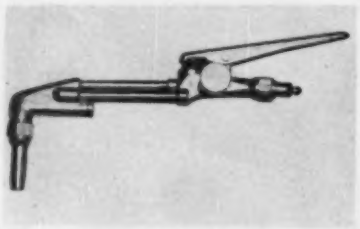
R K LeBlond Machine Tool Co, Madison & Edwards Rds, Cincinnati 8, Ohio

Honing Machines Are Available In Manual or Automatic Models

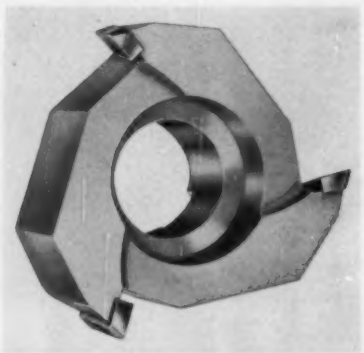
Model 10A1 vertical honing machine is one of four models designed for manual or automatic honing of bores from ⅜ to 2 in. in diameter. Versatility is provided by design of a basic machine with provisions for adding automatic equipment such as a rotary indexing table, magazine feed, pregaging, bore-to-bore sizing, pneumatic hone expansion, feed and collapse, postgaging, sorting, and ejection. On the manual model 10M1 and 15M2, the complete cycle is controlled by two limit switches. Automatic models 10A1 and 15A2 require only four limit switches.

A double post arrangement with the spindle suspended in line between the posts provides the maximum rigidity and accuracy. Model 10A1 (illustrated) has a ⅜ to 1-in.-ID range with a 10-in. swing; max spindle travel is 2½ in. with a 6-in. lift-out stroke. Power is supplied by ¾-hp motor. 10M1 has same capacities but is furnished without automatic attachments. The 15A2 and 15M2 have a ½ to 2-in.-ID range with a 15-in. swing; max spindle travel is 6 in. with an 8-in. lift-out stroke; motor is 2 hp.

Barnes Drill Co, 814 Chestnut St, Rockford, Ill



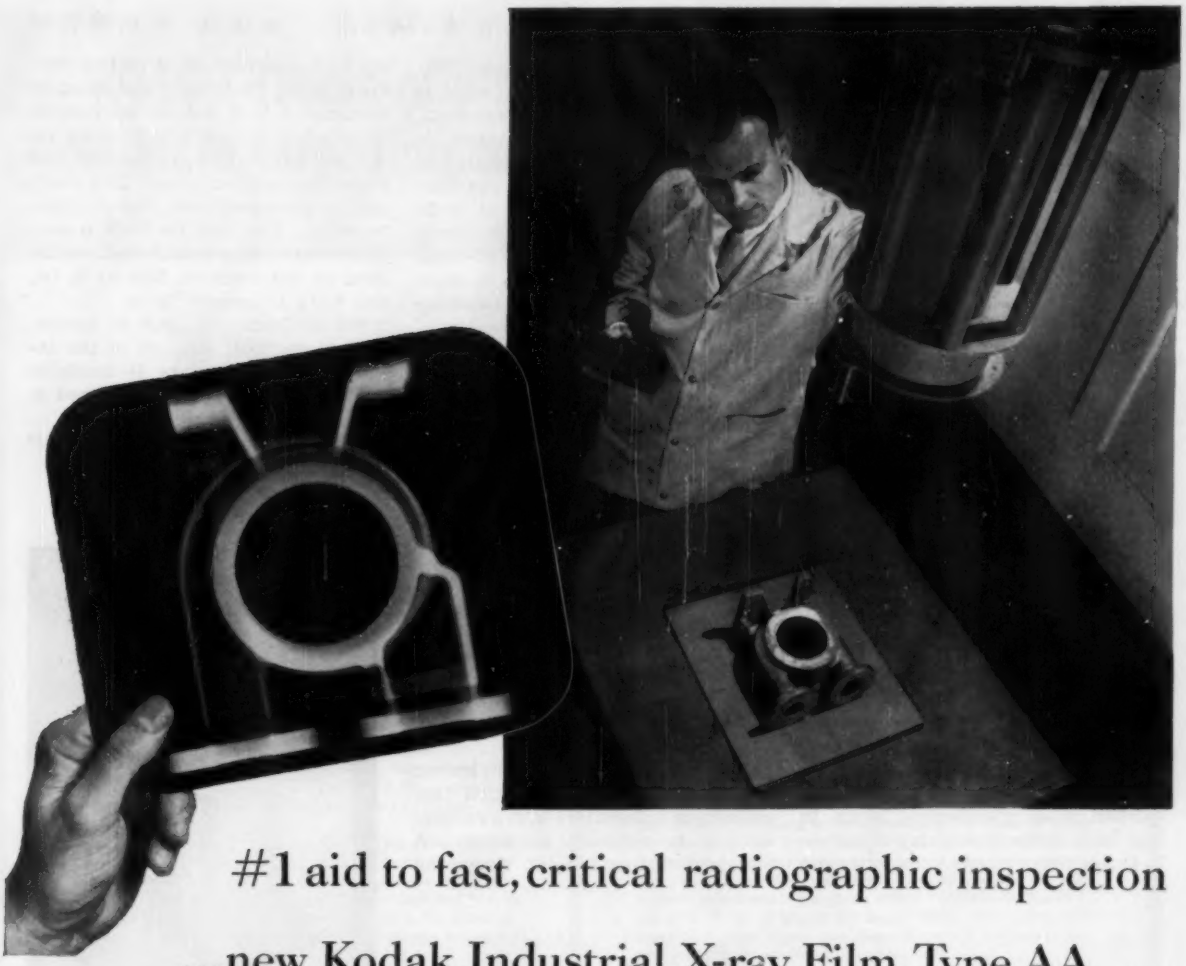
CUTTING ATTACHMENT, Airco 1490, attaches to company's Style 400 lightweight welding torch. Unit weighs 13 oz, measures 9½ in. in length, and is said to have a cutting range up to 1-in.-thick steel. Diaphragm-type cutting oxygen valve eliminates need for valve packing and prevents gas leakage—*Air Reduction Co, Inc, 150 E 42 St, New York 17, NY*



Nelco Introduces New Series Of 3-Flute Shell End Mills

A new group of Series 400, 3-flute, carbide-tipped shell end mills has been designed for face milling operations on aluminum, magnesium, brass or bronze alloys, and plastic materials. Tips are sandwich-brazed to alloy body and reportedly will withstand ultra-high-speed operations. Three-tooth design allows more room for chip flow, and the tooth construction is said to result in superior finish on soft materials. The carbide tips protrude above cutter body to eliminate snagging steel body with the diamond wheel when regrinding.

Nelco Tool Co, Inc, Manchester, Conn



#1 aid to fast, critical radiographic inspection

...new Kodak Industrial X-ray Film, Type AA

TODAY'S radiographic inspections call for increased sensitivity, greater speed. And these are the characteristics of Kodak's newest industrial x-ray film, Kodak Industrial X-ray Film, Type AA.

This film retains all the excellent qualities that made Kodak Type A the most widely used x-ray film in industry. Then, in addition, it provides greatly increased speed.

This permits exposure time to be cut as much as 50%. It allows adjustment of the radiographic factors to obtain greater contrast and easier readability.

Kodak X-ray Film, Type AA can multiply your minutes—can extend the usefulness of your present radiographic equipment.

Find out all the ways it can improve your production. Get in touch with your x-ray dealer or Kodak Technical Representative.

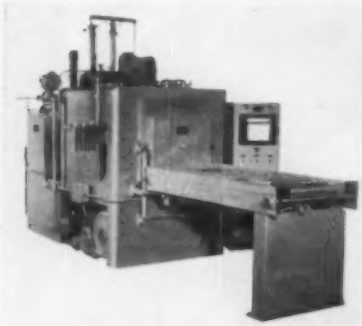
EASTMAN KODAK COMPANY
X-ray Division Rochester 4, N. Y.

Read what the new Kodak Industrial X-ray Film, Type AA, does for you:

- Reduces exposure time—speeds up routine examinations.
- Provides increased radiographic sensitivity through higher densities with established exposure and processing technics.
- Gives greater subject contrast, more detail and easier readability when established exposure times are used with reduced kilovoltage.
- Shortens processing cycle with existing exposure technics.
- Reduces the possibility of pressure desensitization under the usual shop conditions of use.

Kodak

Kodak Industrial X-ray Film, Type AA and Type M is now available in 100-sheet boxes wrapped without interleaving paper. Designated as AA-100; M-100.

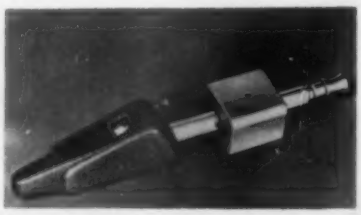


Controlled Atmosphere Heat-Treat System Comes as Package Unit

Clean-Line heat-treating system can be supplied as a package installation, with matching heat-treat furnace and quench tank, endothermic generator, tempering unit, and automatic washer. Basic unit is the furnace (illustrated) for clean hardening, carbo-nitriding, carburizing, carbon restoration, and annealing up to max operating temperature of 1850 F. Automatic straight-through handling of work is provided with a power pusher moving the work into the heating chamber, and a separate pusher head transferring work to the rack in the quenching chamber.

Quenching cycle is automatic, and oil is recirculated by a 2-stage, 300-gpm pump. Heat-treating unit is fired by eight Eclipse gas-fired, vertical burners, and furnace is equipped with alloy radiant tubes. Work area of both the heat chamber and the quench rack is 24 in. wide by 36 in. long by 18 in. high. Over-all dimensions are 20 ft 2 in. long, 7 ft 2 in. wide, and 11 ft 4 in. high. Models using manual work-handling are also available.

Eclipse Fuel Engineering Co, Rockford, Ill

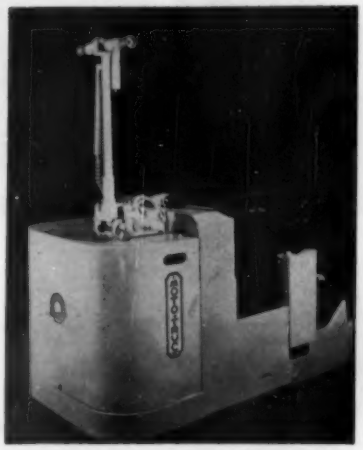


Surface Roughness Is Measured By Mechanical Instrument

Novel mechanical instrument, known as RoDi (Roughness Operated Displacement Integrator) is drawn over surface to measure roughness. A standard diamond point traces out the high and lows relative to a carboloy skid. Motion of the point is transferred to a precise mechanical integrating device which sums up the vertical travels of the point and shows the total on a dial. This reading is averaged over the distance travelled. The type B4 RoDi is supplied with a single skid, and can be used on flat surfaces, ID's to ¾ in., and OD's to approx ⅛ in.

For surfaces too short to accommodate the rear support of the instrument, an accessory is available whereby rear support is attached to standard vernier height gage.

Williamson Development Co, Inc, 317 Main St, West Concord, Mass

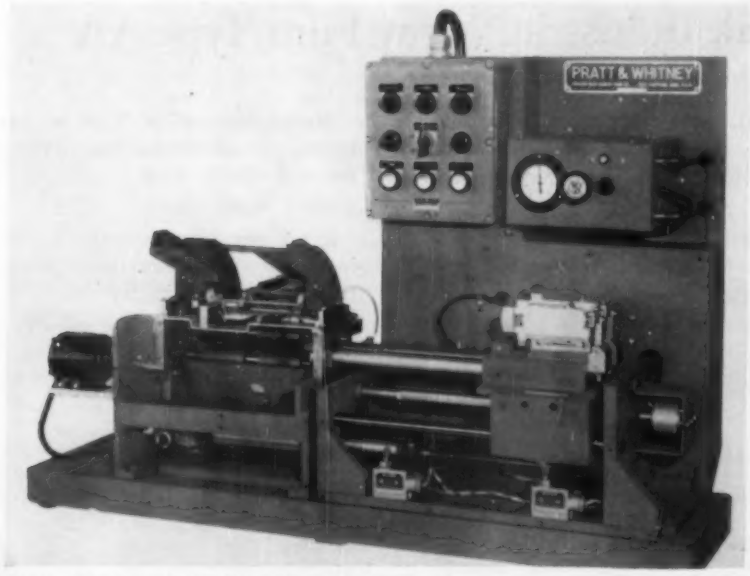


Moto-Truc Adds Push-Pull Tractor To Line of Industrial Trucks

Heavy-duty push-pull tractor is said to develop a drawbar pull three times that of conventional walkie tractors, and this model is rated at 2800-lb pull. Extra pull is provided by dual drive units working in tandem. Company's Perfect Circle steering system is used.

Over-all dimensions are 37 in. wide x 55 in. long, and weight is 2500 lb less battery. Conventional controls provide two speeds forward and reverse. Unit can be equipped with any standard trailer coupling.

Moto-Truc Co, 1959 E 59 St, Cleveland 3, Ohio



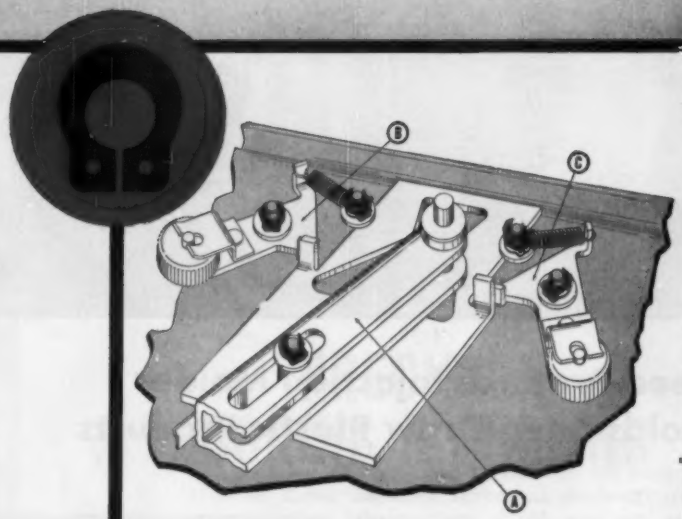
WALL AND BOTTOM THICKNESS of impact-extruded aluminum tubes is checked on this automatic gaging machine that automatically separates them into good, rectifiable, and rejected categories at the rate of 1000 units per hr. Tubes are fed into chute and then transferred to a nest of rubber rolls rotating at approx 600 rpm. As tubes rotate, gaging contacts enter open ends checking wall thickness on the helix that is generated. At end of stroke, bottom thickness is measured—*Pratt & Whitney Co, Inc, West Hartford 1, Conn*

Hand pallet truck has been redesigned and features a reinforced handle, relocation of grease fittings, and stronger axles. Truck has a capacity of 1 ton and a standard 4-in. lift. Details available in Bulletin 226.

Raymond Corp, 47-150 Madison Ave, Greene, NY

Waldes Truarc grip rings used on die-cast studs eliminate threading, tapping, other costly machining

Mark Simpson Manufacturing Co., Long Island City, N. Y., uses Waldes Truarc series 5555 Grip Rings to secure parts to studs of the zinc die-cast base of its "Masco 500" portable tape recorder.
The rings—which need no grooves—replace nuts, screws, cotter pins and other types of fastening devices which require threading, tapping, drilling and other expensive machining operations. Because a single cracked or broken stud would render the entire cast base useless—and with it, all assembly completed to that point—the rings also eliminate extremely costly rejects.



Pivot Assembly of shift lever (A) is secured by a single Waldes Truarc Grip Ring and washer. Because the washer must be installed over the shift level in a sliding fit, critical tolerances would have to be maintained if a screw or cotter pin were used. The Truarc Grip Ring eliminates that problem: it requires no groove and may be seated over the washer at any point on the stud, automatically compensating for accumulated tolerances in the parts. BRAKE ASSEMBLIES (B and C) use Grip Rings to secure the brake wheel and spring subassemblies. Here again problems of critical tolerances are avoided and expensive rejects eliminated.

Whatever you make, there's a Waldes Truarc Retaining Ring designed to improve your product... to save you material, machining and labor costs. They're quick and easy to assemble and disassemble, and they do a better job of holding parts together. Truarc rings are precision engineered and precision made, quality controlled from raw material to finished ring.

36 functionally different types... as many as 97 different sizes within a type... 5 metal specifications and 14 different finishes. Truarc rings are available from 90 stocking points throughout the U. S. A. and Canada.

More than 30 engineering-minded factory representatives and 700 field men are available to you on call. Send us your blueprints today... let our Truarc engineers help you solve design, assembly and production problems... without obligation.

For precision internal grooving and undercutting... Waldes Truarc Grooving Tool!

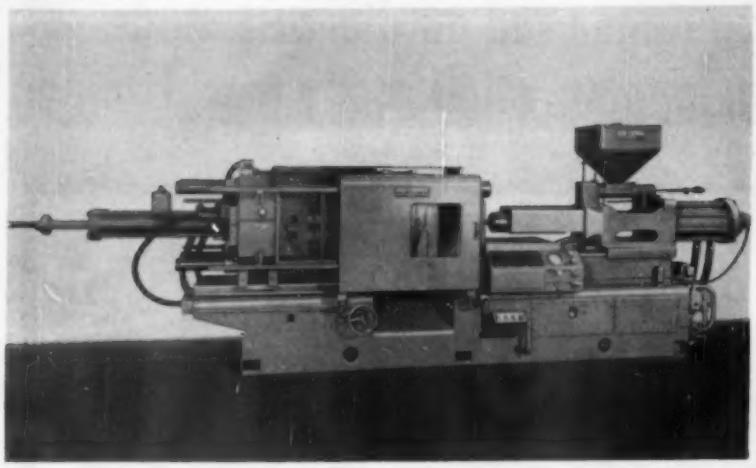
WALDES
TRUARC®
RETAINING RINGS
WALDES KOHINOOR, INC.
47-16 AUSTEL PLACE, L. I. C. 1, N. Y.

Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C. 1, N.Y.
Please send the new supplement No. 1 which brings Truarc Catalog RR 9-52 up to date.
(Please print)

Name .....
Title .....
Company .....
Business Address .....
City ..... Zone ..... State .....

AM079

WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U. S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,491,310; 2,509,081; 2,544,631; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787, and other U. S. Patents pending. Equal patent protection established in foreign countries.



Reed-Prentice Injection Molder Molds Deep-Draw Plastic Products

Designed for molding of deep-draw plastic products in the 12 to 16-oz range, the new 300TL machine offers an adjustable mold clamping stroke from 8 to 20 in. Dry cycle time of this new long-stroke model is 12 seconds. Mold platens measure 29 x 32½ in. Space between the 4-in.-dia tiebars is 15 x 20½ in. Max mold size is 29 x 20½ in.

Through multiple injection strokes, a built-in stuffing arrangement makes possible production runs on parts weighing 16 oz or more. An optional low-pressure die-closing arrangement prevents damage to the mold in the event a molded piece fails to eject when running automatically. Heating cylinder plasticizes up to 125 lb of polystyrene per hr. New spreader design is said to assure thorough plasticizing of all thermoplastic materials.

Double gear toggle mechanism provides positive mechanical mold locking pressure—strain-gage tested at over 350 tons. Die space adjustments are made hydraulically rather than mechanically, thus saving time and effort.

Machine controls are grouped in central panel. Pyrometers and cycle timers are mounted in separate cabinet.

Reed-Prentice Corp, Worcester 4, Mass

TURNTABLE is 40 in. in dia, 36 in. high, and has spring-loaded stop at the 90° points. Wheelrails may be moved apart or brought together by merely loosening and tightening the adjusting nuts—*Sage Equipment Co, Inc, 30 Essex St, Buffalo, NY*

Lead hammers with wood handles have been added to company's line of shop tools, and are available in 1½, 3, and 5-lb sizes.

Podlin Tool Co, 1191 Franklin Ave, Franklin Park, Ill

Cutoff Tool Is Now Available With Carbide-Tipped Blades

Carbide-tipped blades are now available for company's cutoff tool. Tool can be purchased with these blades, or blades can be purchased separately for tools already in use. Two new models of the tool have also been introduced: a 4-in.-dia-capacity tool is available in a heavy-duty model, and a 6-in.-dia-capacity model has been added to the line. Blades for both of these models come in HSS and carbide in cutting widths of 0.090 in. for the 4-in. model, and 0.125 in. for the 6-in. model.

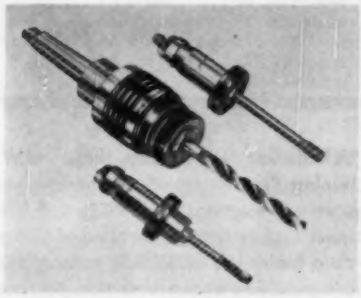
Criterion Machine Works, 765 W 16 St, Costa Mesa, Calif

Rubberized and Steel-Mesh Belts Are Available for Conveyor

Portable conveyor units are adaptable to any required height or length. Riveted sections are bolted together making the conveyor expandable to 32 ft from a standard 12-ft length. Conveyor is made both as Model 600-ZA with a self-cleated rubberized belt and as Model 600-ZM with a steel-mesh belt.

Units are available in both 6 and 12-in. belt-trough widths. Standard belt speed is 135 fpm, but can be varied through pulleys. Units will operate in either direction and at inclines up to 30°.

American Planter Co, Burr Oak, Mich



German Quick-Change Chuck Has Runout Tolerance of 0.00039 In.

Hassner quick-change chuck can be used in the horizontal or vertical position, and has a runout of only 0.00039 in. Special models with tolerance of 0.00019 in. are available at extra charge. There is no need to stop the machine to change tools. Small-size tools can be changed at rpm's up to 7000, larger ones at speeds to 3000 rpm. Chuck can be operated in both cw and ccw directions, thus permitting thread-cutting operations. Special thread-cutting inserts are available.

Imported and distributed by Karl A Neise, 404 Fourth Ave, New York 16, NY

Last word in capacity, accuracy and speed!

KNIGHT'S NEW No. 60 VERSATILE VERTICAL for PRECISION BORING & MILLING

Unusual Extra Capacity. 18″ cross feed—30″ vertical travel

Rugged Bed-Type Table. Has 3-way bearing. Bed 36″ wide; saddle 46″ long

Convenient, Simple Operation. Longitudinal handwheel in front; easily moved counterbalanced spindle and spindle head

Choice Of 3 Measuring Methods. Hardened and ground precision screws—locating counters—dial indicator equipment

Many Other Exclusive Features. Mail coupon today for complete information

TWO TABLE SIZES
18″ x 52″—28″ longitudinal travel
18″ x 60″—36″ longitudinal travel

W. B. KNIGHT MACHINERY CO.
3920 WEST PINE BLVD. • ST. LOUIS 8, MO.

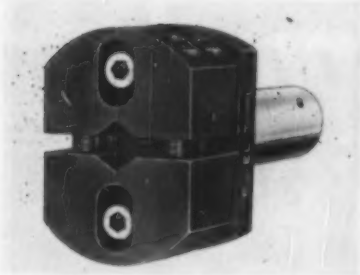
ATTACH TO COMPANY LETTERHEAD

W. B. KNIGHT MACHINERY CO.
3920 West Pine Blvd., St. Louis 8, Mo.
Send complete information on new No. 60 Vertical.

Name.....

Title.....

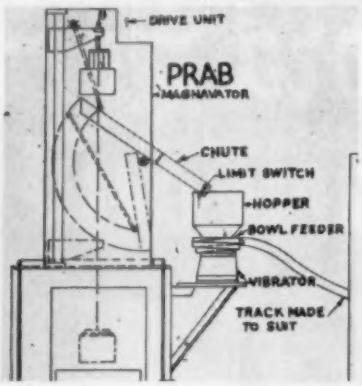
☐ Have representative call



Drill and Reamer Holder Available in Three Shank Sizes

RoyEL 1½-in.-capacity drill and reamer holder is available in three shank sizes: 1¼, 1½, and 1¾ in. Designed for use on multiple spindle automatics and turret lathes, holders utilize pair of independently mounted sliding jaws which provide 4-point holding. Device does away with need for collets and bushings, and because the shank is hollow, there is no need for cutting off tool shanks.

RoyEL Tools, 4221 Excelsior Blvd, Minneapolis 16, Minn

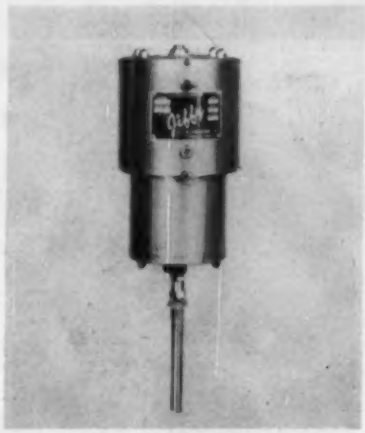


System Transfers, Meters, and Feeds Small Parts to Machines

Completely automated small parts feeding system handles pins, nuts, rivets, stampings, and other small parts. Company's Magnavator, a small parts elevator, is used in conjunction with a bowl feeder. Small ferrous parts are picked up by a magnetic head, and are lifted by a chain-drive mechanism. At a pre-determined level, the magnets in the head move away from the head housing and the air gap which is formed allows parts to fall to a receiving tray. Tray is hinged and its position is governed by the location of the lifting mechanism.

When tray is in position it joins the discharge spout, and the parts slide down through a demagnetizer to the mouth. Here, a limit switch controls the material level of the container being fed. The bowl feeder, agitated by a vibrator, draws from the hopper and automatically feeds, aligns, and meters parts to the desired press or machine.

Prab Conveyors, Inc, 30121 Groesbeck Highway, Roseville, Mich



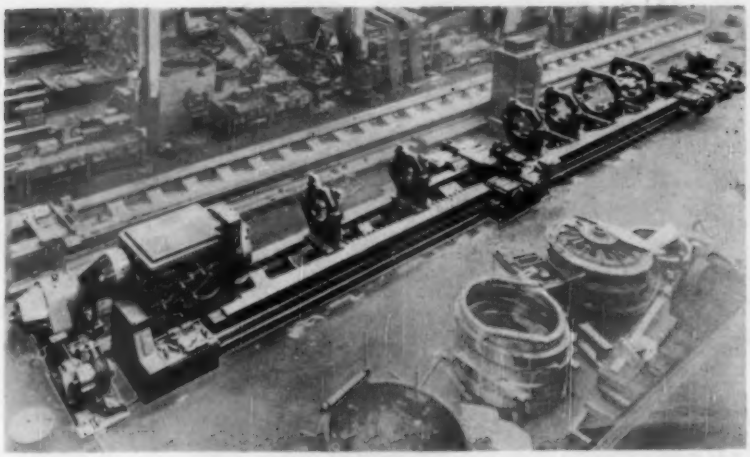
DISINTEGRATING MACHINE, Model J-1, chucks into any drillpress and requires only connections to a water line and a 115-v outlet. Unit is 8 in. long and 5 in. in dia, sells for $249, and is said to be capable of burning out broken taps and drills as fast as many higher-priced machines — *Jiffy Disintegrators, Inc, 1503 East 11 Mile Rd, Royal Oak, Mich*

Double-Acting Hand Pump Is Designed for 10,000 psi

Variable-leverage hand pump, Model 1687, has patented internal toggle linkage and a capacity of 0.475 cu in. per cycle (2 strokes)—more than three times the max capacity normally used with a constant-leverage hand pump for 10,000 psi.

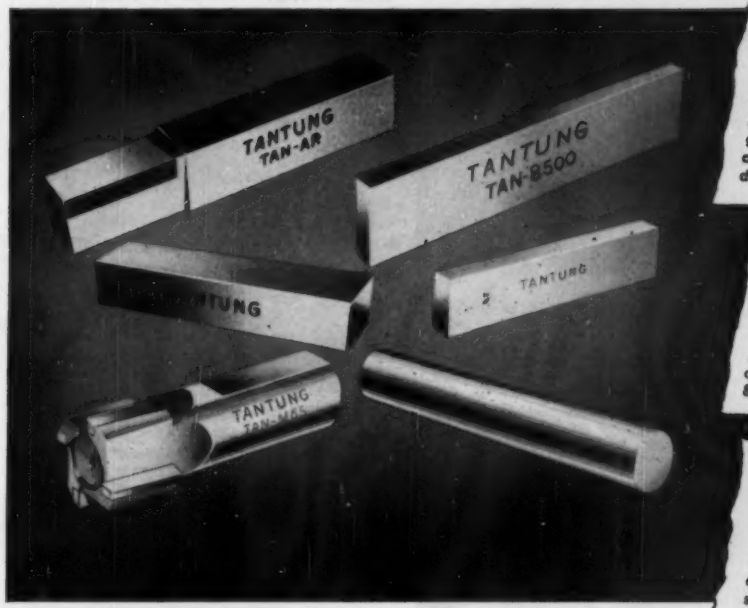
Designed primarily for cranes, winches, stackers, and other material handling applications, pump is normally used with a 28-in. length of ¾-in. pipe for a handle. At 10,000 psi, operator uses left-hand portion of stroke for a 3.5 to 1 mechanical advantage. Manufacturer states that, when lifting light loads at lower pressures, the right-hand portion of the stroke would give better than three times the usual speed.

Mechanisms Co, 118 East 2nd St, Uhrichsville, Ohio.



HIGH SPEED LATHE, Niles A-50, with 50-in. faceplate, swings 38 in. over the carriage bridge and 52 in. over carriage wings and bed. Machine was developed specifically for high-speed carbide tool service. Motors up to 100 hp can be used. Spindle speed range is 1.5 to 182 rpm; feed speed range is 0.0025 to 0.625 ipr for longitudinal and 0.0012 to 0.312 ipr for cross feed. Lathe can be furnished as standard turning lathe or as combination boring and turning machine—*Baldwin-Lima-Hamilton Corp, Hamilton Div, Hamilton, Ohio*

How to Reduce Machining Costs with V-R Tantung Cutting Tools



TANTUNG IN PLACE OF HSS INCREASES PRODUCTION 2½ TIMES

In recessing a high alloy steel forging in a semi-automatic, HSS was being run at 94 rpm, .004" feed, .125 depth of cut—35 pieces per grind, 38 pieces per shift. Tantung was employed at 165 rpm, .008" feed, .125" depth of cut. Production: 70 pieces per grind, 100 pieces per shift!

TANTUNG OUTLASTS CARBIDE 8 TO 1 ON MILLING OPERATIONS

In rough milling spheroidized Armco steel (170-190 Brinell), carbide cutters averaged 100 pieces per grind because of too low an allowable machine speed. Tantung tipped cutters now produce 800-900 pieces per grind!

TANTUNG CUTS TOOLING COST FOR SHORT RUNS ON AUTOMATICS

Users report Tantung saves as much as 50% over carbide tooling costs for short runs on automatics—because Tantung is easy to grind with aluminum oxide wheels and is also available in standard solid tool bits, permitting many regrinds.

TANTUNG bridges the gap between maximum cutting speeds possible with high speed steel and minimum speeds practical with carbides. Generally *Tantung* can be started at speeds 50% higher than HSS—and on many applications you can cut up to 100% faster. *Tantung* is also ideal when slow speeds cause build-up when using carbides.

Tantung will appreciably reduce machining costs on the following applications:

1. Older Machines When machines lack the speed or rigidity to successfully use carbides, *Tantung* will permit up to double, or greater, the production possible with HSS.

2. Multiple Operations. In turning an O.D. at high speed using carbide and simultaneously boring an I.D., the boring surface speed is often too low for carbides. *Tantung* is the answer.

3. For Automatics. *Tantung* is an ideal cutting tool material, particularly on short runs. Grinding costs less than for carbide. Solid *Tantung* tool bits permit many regrinds, reducing tool cost over carbide. *Tantung* is more efficient at moderate speeds.

FOR COMPLETE INFORMATION, ask for literature. Call your V-R Representative or Distributor, or write:

TANTUNG
is a Chill Cast Alloy . . .

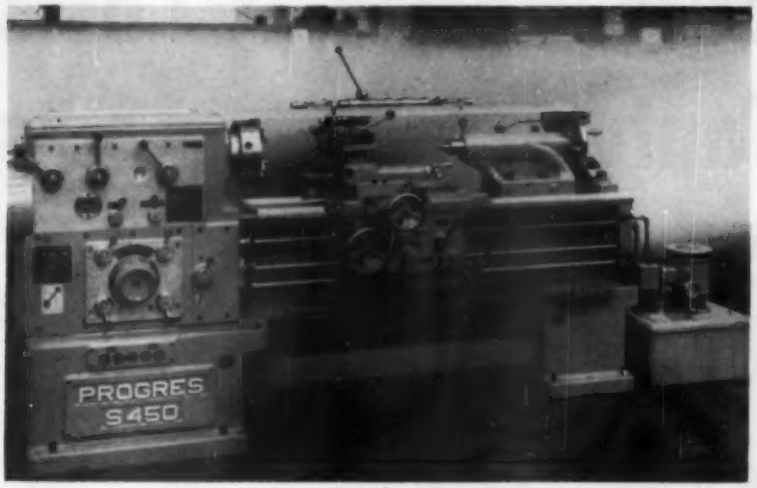
. . . it has high red hardness . . . high transverse rupture strength (about double that of most cast alloys) . . . low coefficient of friction . . . high shock resistance. It is available cast to form to your prints as well as in solid tool bits, tipped tools, cut-off blades and full length toolholder inserts.

ASK FOR BOOKLET

Complete data on what Tantung *is . . . where and how to use . . . how to grind and braze. Will answer nearly every question you might ask. Get your copy, without obligation. Write or call today.*

MANUFACTURERS OF:
CEMENTED CARBIDES, TOOLHOLDERS and TANTUNG® CAST ALLOY CUTTING TOOLS

Vascoloy-Ramet Corporation
SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION
862 Market Street • Waukegan, Illinois



Belgian High-Speed Lathe Features Vibration-Free Block

Built in Belgium by Le Progres Industriel, S A, the new 17-in. S450 geared-head lathe is arranged for direct multiple V-belt motor-drive. Start, stop, and reverse of spindle are controlled by multiple-disk friction clutch. Headstock is all-geared, and has 18 spindle speeds ranging from 15 to 1500 rpm in geometric progression. Quick-change gear box is completely enclosed and provides 40 feeds for turning and facing, 40 U S standard threads, 40 metric, and in addition, 40 coarse threads.

Entire bed is cast in one piece with machine legs, providing increased rigidity and vibration-free block. Standard equipment includes automatic disengaging of the longitudinal and one cross-feed stop. Cross-slide is equipped with a double screw for a single toolholder at the rear or for hydraulic copying attachment. Bulletin available.

Imported by Parker Machine Co, Inc, 158 Pioneer St, Brooklyn 31, NY

Masking tape, Scotch No. 214 (Type 2MNB), is designed for use in temperatures up to 300F for bakes up to 8 hr in duration. It will withstand 400F for shorter cycles. Tape has crepe-paper backing and a pressure-sensitive adhesive, has a tensile strength of 20 lb per in. of width, an adhesion to steel of 25 oz per in. of width, an elongation of 9%, and is 8 mils thick. It is available in standard roll lengths of 60 yd and in any width.

Minnesota Mining and Mfg Co, 900 Bush St, St Paul 6, Minn

Self-Contained Unit Drills, Bores Taps, and Counterbores

New line of self-contained units for drilling, boring, tapping, counterboring, step-drilling, and other applications requiring high torque, is named Robotorq. Units can be mounted in any position to suit production requirements.

Motor, drive, and controls are housed in a flange-mounted sealed case. Long stroke, from 6 in. up, permits use on wide range of work including deep boring; high torque, from 35 to 4000 ft lb, permits taper tapping and other heavy-duty operations. Built-in torque limit protects machine and work; signal warns of overload. Reversing mechanism automatically counts revolutions, backs out tap, and clears the piece. Bulletin DR-457.

George L Day Co, 1227-31 Niagara St, Buffalo 13, NY

New Product Added to Line of Chromate Conversion Coatings

Four new products have been introduced into the Iridite family of chromate conversion coatings. Iridite 5-P is powdered concentrate which produces a yellow iridescent coating on zinc and cadmium plate, galvanized iron, and zinc die castings. Iridite 8-4 is an all-purpose liquid chromate for all forms of zinc and cadmium. Iridite 12-P is a powdered material designed to provide a one-dip, clear, blue-bright finish on zinc-plated parts. Iridite 14-9 is a powdered concentrate formulated to provide one-dip, clear protective treatment for aluminum surfaces.

Allied Research Products, Inc, 4004-06 E Monument St, Baltimore, Md

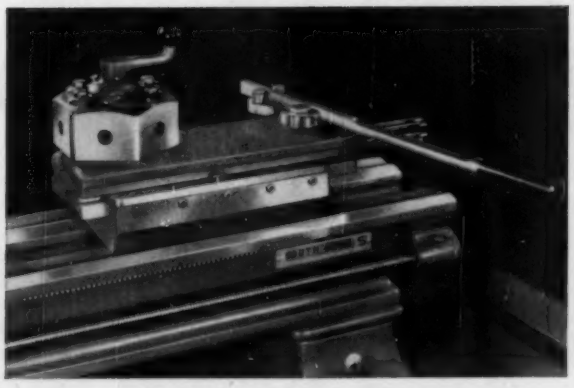
Unit Dust Collector Is Designed For Small Machine Operations

Self-contained unit, Dust-Master, can be placed at any small grinding, polishing, buffing, blasting, or other dust-creating machine. Unit has centrifugal blower, driven by 1/3-hp motor. This, with a large dust filter bag is mounted on a cast-aluminum cover which fits any 20 or 24-gal waste can. Standard equipment consists of line cord, plug and switch, and 5 ft of flexible 3-in. suction hose. A 4-wheel dolly is also available. Unit, less can, sells for $100.

Cincinnati Fan & Ventilator Co, Gomery Rd, Cincinnati 7, Ohio

Simplify Repetitive Operations
WITH
SOUTH BEND TURRETS

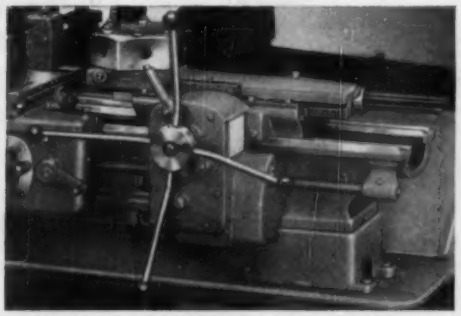
Precision-built for precision work, these South Bend Turrets simplify tooling for repetitive operations that must be held to very close tolerances. Their rigidity and accuracy permit use of maximum cuts and spindle speeds. They are representative of 165 attachments, tools and accessories that are designed for South Bend Lathes. Use them to simplify routine operations or to tool up special jobs economically. Reasonable prices enable you to do this profitably — another reason for using South Bend Lathes.



HANDLEVER BED TURRET

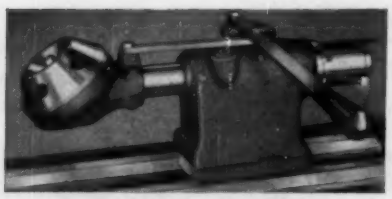
Mounts any place on bed. Indexes ± .0005" at 4" from turret face Hardened, ground and superfinished index pin. Indexes automatically. Automatic feed stop for each position. Effective slide feed 4". Tool holes ⅝" or ¾".

Size Lathe	Catalog No.	Price
9"	CL1611N	$284
Light Ten	CL1611K	291
10"	CL1611R	298
13"	CL1611T	320



POWER FEED TURRET FOR 13" LATHE

Has independent feed trip and stop for each of the six turret faces. Effective feed of turret slide is 6½". 144 power turret feeds .0006" to .1093". Turret head indexes and locks automatically on the return stroke of the turret slide. Turret ram lock is provided. Price $726



HANDLEVER TURRET

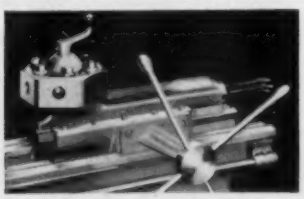
Replaces tailstock. Index lock releases automatically. Automatic feed stops. Manual indexing of turret. Holds 6 tools with ⅝" shanks. Maximum stroke length of turret slide is 3¾".

Size Lathe	Catalog No.	Price
9"	CL2045N	$120.50
Light Ten	CL2045K	128.00
10"	CL2045R	139.50
13"	CL2045T	167.50

SQUARE TURRET TOOL BLOCK
for Compound Cross Slide

Mounts 4 cutting tools. Turret indexes within .0005" to 4 positions. Quick acting lever lock.

Size Lathe	Catalog No.	Price
9" & 900	CL3375N	$47.75
Light Ten	CL3375K	50.50
10" & 1000	CL3375R	54.00
13"	CL3375T	60.75
14½"	CL3375F	87.25
16" & 2-H	CL3375H	94.50



HAND FEED TURNSTILE BED TURRET

Mounts any place on bed. Indexes ± .0005" at 4". Hardened, ground, and superfinished index pin. Indexes automatically. Automatic feed stops. Turret ram lock is provided.

Size Lathe	Catalog No.	Price
16"	CL1917H	$710
13"	CL1917T	515

All prices f.o.b. factory

SOUTH BEND

PLEASE SEND INFORMATION CHECKED:

☐ 9" and 10" BENCH LATHES ☐ 10" to 16-24" FLOOR LATHES ☐ DRILL PRESSES ☐ ½" & 1" Collet TURRET LATHES ☐ TOOL GRINDERS ☐ 7" BENCH SHAPERS ☐ MILLING MACHINES

Name_____ Street_____

City_____ State_____

Building Better Tools Since 1906 • **SOUTH BEND LATHE** • South Bend 22, Indiana

Setting Master Sets Any Dial Bore Gage From 0 to 14 In.

Dial bore gage setting master eliminates need for master ring gages or gage block and surface plates in setting dial bore gages. Two models are available: one will set all gages from 0 to 7 in., other (illustrated) ranges from 0 to 14 in. Master can be set to XX accuracy in less than 5 min with gage blocks, can be used vertically or horizontally, and is light enough to be carried.

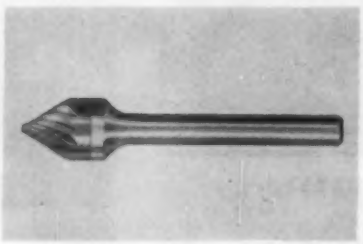
Standard Gage Co, Inc, Poughkeepsie, NY

Pneumatic Impact Hammer Operates At 2000 to 4000 cpm

Model 200-RH is latest in the RH or Repeating Hammer series of pneumatic impact machines. It differs from its opposite model number in the VS or Variable Stroke series (*AM*—Dec 19 '55, p159) in that it uses a somewhat smaller hammer of constant stroke, with impact force regulated by adjustments in air pressure. Hammer cylinder is brought down until tool presses on work. This contact pressure opens the hammer valve, and so long as tool is held down the hammer will repeat, striking from 2000 to 4000 times per min. Traverse of tool to work is controlled by foot valve.

Max riveting capacity in mild steel is 5/16-in. dia. Machine is also useful in staking, crimping, coining, force-assembling, and impression marking.

Heidrich-Nourse Co, 631 E Third St, Los Angeles 13, Calif



Solid Carbide Countersink Bur Produces Mirror Ground Finish

Countersink-type solid carbide bur with right-hand spiral flutes reportedly produces a mirror ground finish. Tests using the new bur (M-shape) to countersink ¼-in.-dia holes in hardened die steel, R$_c$ 62-63, are said to have proven it far superior in speed and surface finish to other tools. Bur was used at 300 rpm. Positive shearing action and excellent chip ride-out produced a high finish. Chamfer was sunk to full diameter of tool, which showed no wear after countersinking 20 holes.

Production of Atrax burs was described in a feature article earlier this year (*AM*—Mar 11 '57, p126).

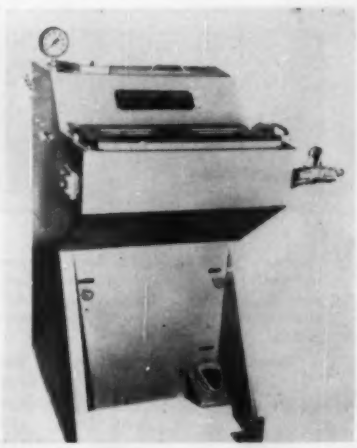
Atrax Co, Newington, Conn

Hydraulic Bar Feed Is Designed For High Speed Screw Machines

Model S Hydra-Lite feeder is designed to feed stock accurately, even at the high spindle speeds designed into late model single-spindle screw machines. New short piston allows feeding of stock at highest spindle speeds without stopping spindle—no fingers to gall or mar stock—positive feed-out insures control of lengths within a few thousandths. Newly patented Swing Stop is an accessory that controls length of piecepart as accurately as turret stop. It is necessary to use a second operation clutch to assure trouble-free operation. Signal light warns operator when stock is low. Units are available in three sizes, capacities ranging from 3/32 to 1¾ in.

Boyar-Schultz Corp, 2000 South 25th St, Broadview, Ill

HEAVY-DUTY DRILL, Model H, develops 22 ft-lb torque at speed of 1000 rpm, is equipped with ½-in. Jacobs chuck, and weighs only 9 lb. Gear case can be removed without disturbing motor; motor bearings are preloaded. Other features include a boss for attachment of ½-in. pipe to offset torque, positive-acting governor, positive oiling system, and double-acting throttle. Over-all size is 5½ x 14 in.—*Air Speed Tool Co, 1502 W Slauson Ave, Los Angeles 47, Calif*



Wet Blast Machine Deburrs Small Machined Workpieces

Operated from a sitting position, machine is adaptable to deburring of small machined parts, satin-finishing of decorative pieces and jewelry, and stripping wire ends. Parts are processed two at a time. Masks may be fitted in work-loading bays for protection of workpiece areas not requiring blasting, or to achieve different degrees of blasting.

Cro-Plate Co, Inc, 747 Windsor St, Hartford, Conn

Your choice of normal or low starting current... with Performance-Rated

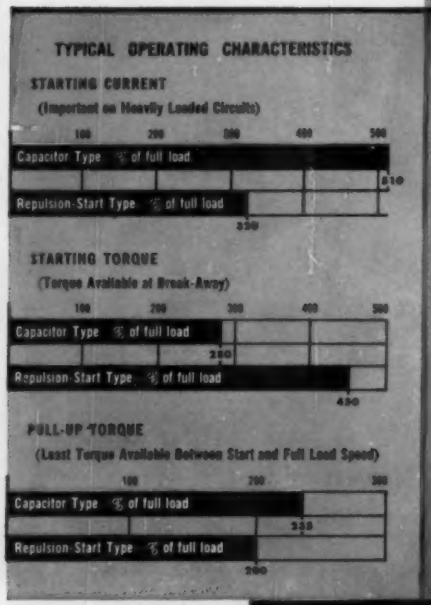
Century

HIGH TORQUE, SINGLE-PHASE MOTORS

Capacitor Motors... ⅛ to 20 H.P. provide high starting torque, high pull-up torque and require normal starting current. They are available in drip proof, dust proof and explosion proof enclosures.

Even if you have severe starting current limitations, you can select the torque you need for sure starts and smooth pull-up to speed from the Century Performance-Rated Single-Phase line (see bar chart below for operating characteristics of two types of Century Single-Phase Motors).

Whatever Your Motor Job . . . there's a Century Motor Performance-Rated to handle it with top effectiveness. Contact your nearby Century branch office or Authorized Distributor.



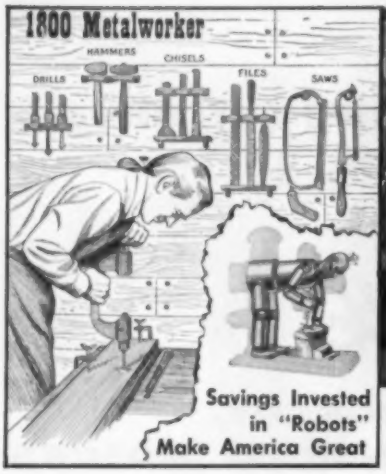
Repulsion Start, Induction Motors (type RS)... ½ to 7½ H.P. provide very high starting torque, yet require unusually low starting current. They are available in drip proof and splash proof enclosures.

Performance-Rated© Motors ⅛ to 400 H. P.

CENTURY ELECTRIC COMPANY

CE-32

1806 Pine Street, St. Louis 3, Missouri • *Offices and Stock Points in Principal Cities*



Savings Invested in "Robots" Make America Great

DoALL band machine offers the newest machining concept, an unrestricted work zone, with no limit to the length or direction of the cut.

By 1967 each worker will require far greater investment in tools than the $12,500 of today.

Mr. Congressman: Don't Kill the Goose

Unrealistic taxation is throttling savings and investment in the "tools" of production, the real source of America's greatness. Industrial productivity is losing ground in relation to the increasing population.

A brief review of our industrial system helps explain the situation.

About 150 years ago, robots, called machine tools, began replacing hand tools. Work was clamped in a vise, while a power-driven cutting tool, traveling in a completely controlled path, performed the desired machining operations. Thus, it was possible to turn out many pieces exactly alike, rapidly and accurately. Also other "tools," such as steam engines and steel rolling mills, could now be produced with these machine tools.

New products at low prices began to flow to market. People had more and better clothing and food and new kinds of services. And, every time savings were invested in better "tools," more abundance resulted.

Today, things are going wrong with this process. Demand for capital to purchase "tools" has been greater than the savings available. Bank credit has been used instead, so the price of money has risen. This is a principal reason for inflation.

Our national stock of industrial plant equipment increased by $34.9 billion during 1956, resulting in our greatest year of prosperity. But so far in 1957, capital spending isn't keeping pace with our expanding population and relatively smaller labor force. Prices are up because wages have risen more rapidly than the productivity of workers. Tight money throttles business expansion. The goose that lays the golden eggs is getting such bad treatment that the following legislation is urgent:

(a) Change the tax law that ignores the fact that the dollar's purchasing power to replace equipment shrinks faster than the machinery depreciates, thus making less and less of industry's declining profit available to finance growth and expansion.

(b) Reduce Government spending and general taxation so that more profits and savings for capital equipment can be accumulated.

(c) Eliminate double taxation of earnings and dividends which discourages the accumulation and investment of savings.

Only the productive can be strong. Only the strong can be free.

Reprints of this series on economics available for your employees.

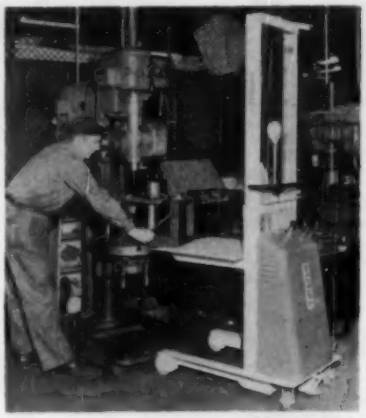
MACHINE TOOLS to increase human productivity in sawing, grinding and lapping are the specialty of The DoALL Company. DoALL also provides industry with more than 1500 cutting tool, gaging and supply items. Literature available upon request.

E-1569

The DoALL Company

Des Plaines, Illinois

38 Local Sales-Service Stores

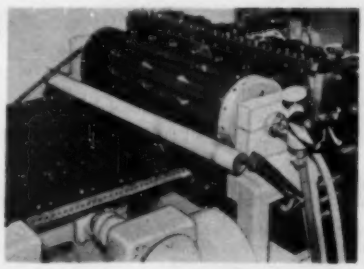


Barrett Portable Elevator Lifts Loads up to 750 lb

Barrett Model BH-7.5 battery-operated hydraulic portable elevator lifts loads up to 750 lb with the flip of a lever. Lift has single control for raising and lowering. Two 6-v automotive batteries are standard power for hydraulic system, but 12-v battery may be used.

Unit has capacity of 750 lb, lift of 71 in., and an over-all height of 83 in. Full lift at capacity load is made in 9.5 sec. Standard platform is 23¾ in. long by 24 in. wide, and 6 in. above floor in lowered position. Efficient battery charger is built-in.

Barrett-Cravens Co, 628 Dundee Rd, Northbrook, Ill



Continuous Sheets of Plastic Are Produced by Vacuum Forming

Sheet is taken directly from the extruder and, while still warm and soft, passed over a vacuum roll where it is formed in the desired pattern. The result is a low-cost continuous sheet of formed plastic. Styrene, polyethylene, acetate, and butyrate are currently being formed by this method and other materials reportedly can be used.

Present equipment makes sheets 24 in. wide in continuous lengths,

Pick exactly the right steel for any job from J & L's complete cold finished line

increased drill life 20% with J & L "1213" steel

This manufacturer of wrench socket blanks averaged 400 parts per hour when he changed to J & L "1213" steel. Form tool life increased from 10 to 20 hours. Drill life was 20% longer. J&L "1200" steels provide higher cutting speeds, longer tool life. Get facts from your distributor or write to Jones & Laughlin, 3 Gateway Center, Pittsburgh 30, Pennsylvania.

J&L STEEL

Jones & Laughlin

. . . a great name in steel

MACHINING PERFECTION always starts with the right steel

New data tells how

STUPALOX ***oxide cutting tools***
cut costs...
speed production!

Now at last! In a handy, well-organized booklet for easy reference—facts, figures and other technical data on the complete line of Stupalox oxide cutting tools and holders.

The amazing performance of these tools—developed by Stupakoff engineers—has established new highs in production and profits for users. They have brought about a new era in cutting tool performance. Faster speeds, deeper cuts, smoother finishes, and longer tool life add up to greater over-all economy. Even capital investment can be lowered, since production levels can be maintained with fewer machines and floor space released for other uses.

This new booklet contains all of this valuable information on one of the most exciting developments in the machine and tool industry during recent years. For your free copy, fill out and mail the coupon below.

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SEND *for your FREE copy TODAY!*

Stupakoff Division of
The Carborundum Company
Latrobe, Pennsylvania

Please send me a free copy of Bulletin 257, STUPALOX OXIDE CUTTING TOOLS

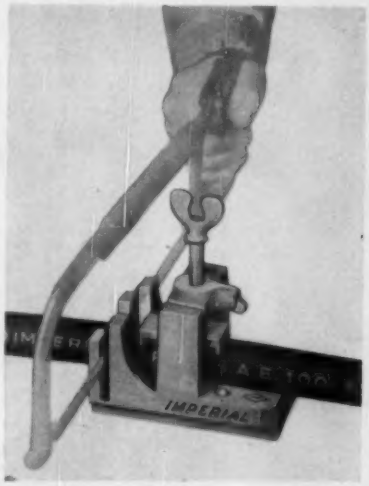
NAME_____ TITLE_____

STREET_____

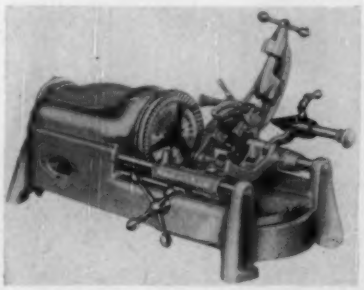
CITY_____ STATE_____

with thicknesses ranging from 0.008 to 0.080 in. The formed sheet may be any color, or black, white, transparent, or translucent. Manufacturer states that stock designs are available and that low-cost test samples, formed to user's drawings and specifications, can be furnished.

Quick Plastics, 1705 Cooper St, Jackson, Mich



SAWING VISE, No. 384F Multi-Use, provides a quick easy way of sawing wire-braid hose and metal tubing up to 1½-in. OD. Special gripper holds material and is said to provide clean, square cut. Vise has ratchet-type slide-to-size adjustment. Bulletin 3067 *—Imperial Brass Mfg Co, 1200 W Harrison St, Chicago 7, Ill*

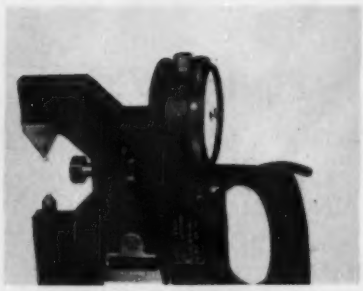


Pipe and Bolt Threading Machine Has Universal Die Head

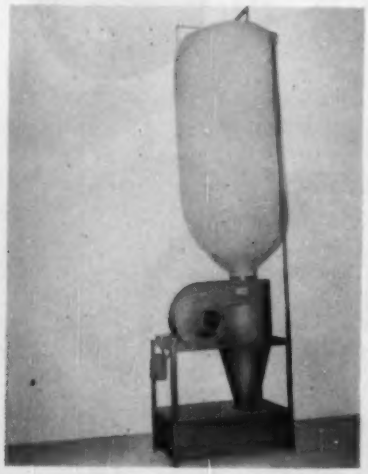
Ridgid 535 pipe and bolt threading machine has a universal die head which, with its two sets of dies, threads ½ to 2-in. pipe or conduit. Priced at $460, the complete package also includes a roll-type cutoff with self - centering, full - floating cutter

wheel, and a 5-flute cone reamer with ⅛ to 2-in. capacity. All tools swing out of way when not in use Wrenches, grease, oil, and an extra cutter wheel are supplied.

Ridge Tool Co, Elyria, Ohio



DIAL SNAP GAGE is said to be shockproof and offers complete visibility of the gage at all times. There is no limit to the depth to be gaged; travel of the indicator may be controlled so that operator cannot misread in second turn of the dial. Designated Nilco, and developed by the Nilsson Gage Co, the gage can be used for involute checking of all helical or conventional gears—giving accurate readings in tenths with the first application of the gage—*Jerico, Inc, 4744 West Lake St, Chicago 44, Ill*



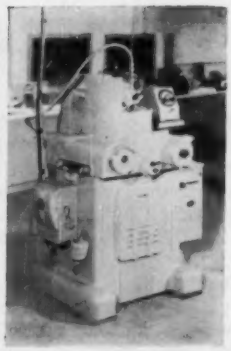
Air-Recirculating Dust Collector Needs No Outside Exhaust Outlet

Aget No. 20C30 is an air-recirculating-type collector, and has an air capacity of 2405 cfm and a dust storage capacity of 6 cu ft. Particles are separated from the air within the unit by a cyclone separator, and the dust

NOW YOU CAN INSTALL ALL YOUR MACHINES

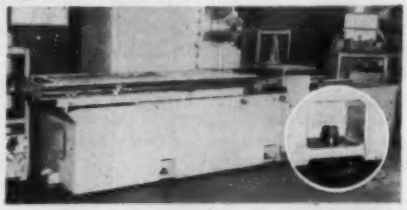
in a low cost "Do-It-Yourself" way by using Air-Loc® 4·17·4

- to reduce vibration and noise
- to permit easy shimming
- to hold precision level

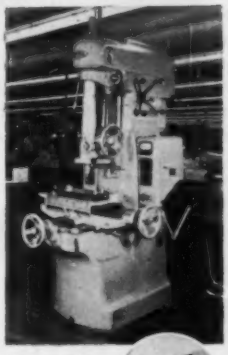


Taft-Peirce 6" Rotary Surface Grinder is on AIR-LOC to reduce transmitted vibration.

You need no bolts or cement with AIR-LOC. Many firms keep sheets of AIR-LOC on hand and cut mounts to correct size. When you move machines, you can re-use your AIR-LOC mounts, which have such great resilience that they do not take a permanent "set".

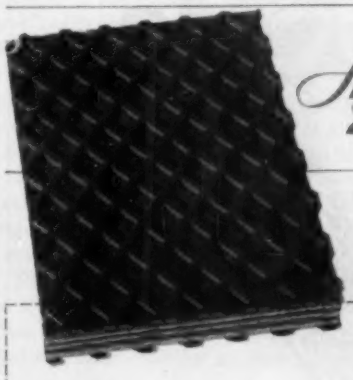


Cincinnati Planer stays level to .0005" installed on 8 AIR-LOC mounts. Leveling screws for precision adjustment.



Moore Jig Borer installed on AIR-LOC mounts without bolts or cement.

Air-Loc® 4·17·4 . . . is an engineered mount that can be loaded to 1,000 p.s.i. It is sold in 18" x 36" sheets, easy to cut with a saw. To *maintain* the precision which is built into your machines, plan now to install them the easy AIR-LOC way.



You get a permanent precision installation with patented AIR-LOC mounts that *Resist* oil, water and alkali, *Permit* easy leveling, *Eliminate* need for bolts or cement, *Hold* machines in place, *Reduce* transmitted vibration from the floor.

Return Coupon for Air-Loc Samples and Booklet.

AIR-LOC DIVISION
Clark-Cutler-McDermott Company
Franklin, Massachusetts

NAME..... TITLE.....
(Please Print)
COMPANY.....
ADDRESS.....
CITY..... ZONE..... STATE.....

NEW SHOP EQUIPMENT

is precipitated into a bin located in the base. Air is exhausted into a 3 x 7½-ft bag, which filters out the finest dust particles and releases the dust-free air into the work area. Bag is cleaned by shaking.

Aget Mfg Co, Adrian, Mich

Shaft-mounted speed reducer is available in most ratings from ¼ to 40 hp at output speeds from 10 to 420 rpm. It is easily mounted on driven machine, while a standard drive motor can be located in any convenient position. Unit has full 360° mounting range around driven shaft and is available in single and double reduction ratings, in ratios of 5:1 and 15:1.

General Electric Co, Gear Motor and Transmission Components Dept, Schenectady 5, NY

Aluminum-bronze electrode, Arc-Braze 20, can be used with dc reverse polarity or high open-circuit ac. It is recommended for braze-welding cast iron, malleable iron, galvanized iron; cast iron to steel, cast iron to bronze; steel to bronze and to aluminum bronze, silicon bronze, or brass—wherever dissimilar metals are to be joined. Strengths range from 70,000 psi on manganese bronze to 90,000 psi on steel. Available in ⅛, 5/32, and 3/16-in. diameters.

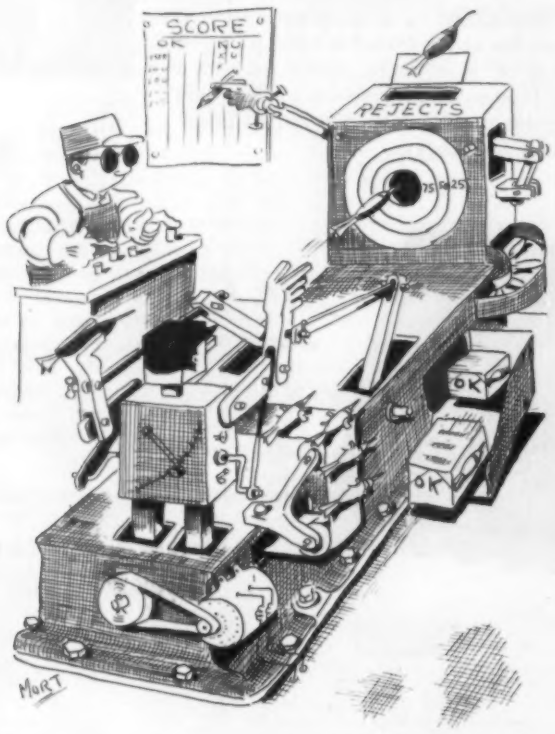
All-State Welding Alloys Co, Inc, 249-55 Ferris Ave, White Plains, NY

Electric balance reel does away with the separate wire cable usually needed to suspend tool. Model 700-BR-LA has extension of 10 ft, and tension may be controlled up to 7 lb; Model 700-BR is similar but has a grounding-type twist-lock connector assembly. Also available is a non-electric model, 700-CR, with a ⅛-in. nylon-covered flexible-steel cable, 6-ft extension, and tension adjustment to 10 lb.

Vacuum Cleaner Corp of America, Cordomatic Div, 1724 W Indiana Ave, Philadelphia 32, Penna

Hard-surfacing electrodes, designated Hardex, are available in 14 different types, each designed to combat a specific type of wear. With

MACHINES OF TOMORROW

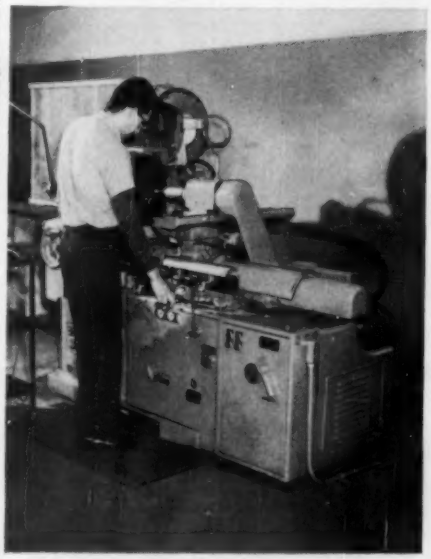


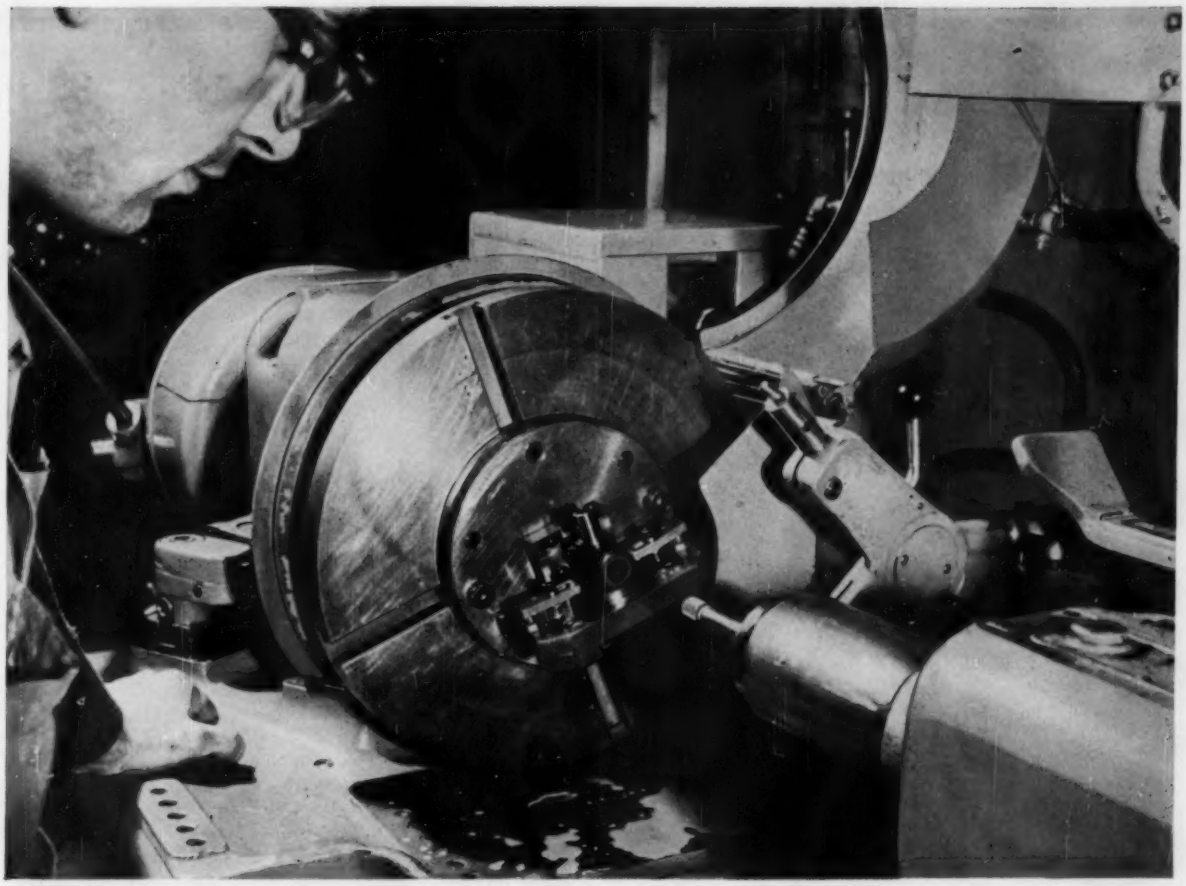
Machine for testing the accuracy of darts destined for the British tavern trade.

(Advertisement)

Meet ERNEST F. HENNIS

. . . one of Bryant's internal grinding experts in the New York area. Like other Bryant representatives he knows grinding problems from "A to Z" and likes to solve them.





"Everything they claimed and then some..."

That's Mr. Gerald H. Buchholz talking. He's owner and manager of the Federal Tool and Instrument Company, Corona, New York, and he's talking about his No. 1116 Bryant Internal Grinder.

For more than two years now, Federal has been turning out close-tolerance work with a Bryant Grinder. Mr. Buchholz leaves no doubt as to its value: "It saves us both time and labor, and it holds tolerances better than any similar machine.

"Before our purchase of the 1116 we used an attachment on another machine for our fine work. But it was too slow for our production. We got the Bryant with an eye toward new business — and we got it!

"This machine has been everything the Bryant people claimed and then some. A man can ask no more than that."

See for yourself how a Bryant Internal Grinder can do better grinding *faster*. Ask for an immediate demonstration!

BRYANT Chucking Grinder Co.

10 CLINTON STREET, SPRINGFIELD, VERMONT

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Internal & External Thread Gages • Granite Surface Plates • Magnetic Drums for Computers • Special Machinery

Profit Grows When The Oil Can Goes!

BIJUR

Automatic Lubrication

You can profit many ways with Bijur Automatic Lubrication. Take a look at the machine tools in your plant . . . chances are they are equipped with Bijur! You are profiting by increased production capacity, reduced maintenance, less down-time, longer machine life and—most of all—by eliminating costly hand oiling.

Why not pass on to your customers these same advantages—build a Bijur system right into the machines you manufacture. You will profit again in goodwill and increased sales.

Bijur Automatic Lubrication is custom-engineered to your equipment. Customers will be assured trouble free service . . . every bearing receives the right amount of oil metered according to individual service requirements.

This dual benefit is just another reason why, for more than a quarter of a century, Bijur has been the accepted standard for automatic machine lubrication.

On the equipment you buy and on the equipment you sell, insist on the best . . . insist on Bijur.

Literature and engineering data are yours for the asking

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BIJUR

LUBRICATING CORPORATION

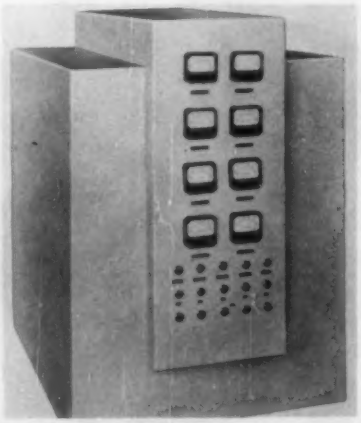
Rochelle Park, New Jersey

Pioneers in Automatic Lubrication

less moisture in the coating, weld metal porosity is reduced and there is less cracking. Field tests are said to have shown that penetration into the base metal and dilution by the base metal is at a minimum, and greater resistance to impact, abrasion, and corrosion is obtained. Electrodes may be used with either ac or dc current employing ordinary welding techniques. Bulletin available.

Metal & Thermit Corp, Rahway, NJ

EMPIRE LAPPING MACHINE laps carbide inserts and milling blades. Unit uses readily available abrasive compound. Grinding time is preset with interval timer. Unit, which occupies 18 x 24-in. bench space, is supplied with one charge of abrasive, three toolholders, three weights, loading fixture, and power cord—*Distributed by Lincoln Industries Co, Minneapolis, Minn*



Controls and Panelboard Systems

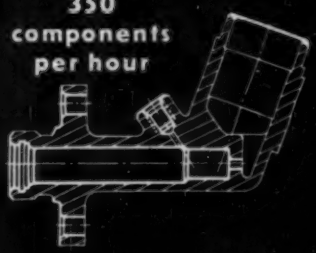
Completely assembled panelboard or console systems, designed for specific control of a process or machine, are available for explosion-proof installation, as well as for dust-tight, air purged, drip-proof, or for regular commercial use. Each system is engi-

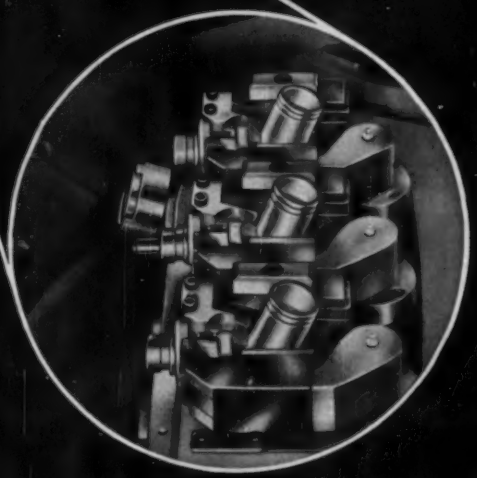
Burr

SPECIAL MACHINE TOOLS

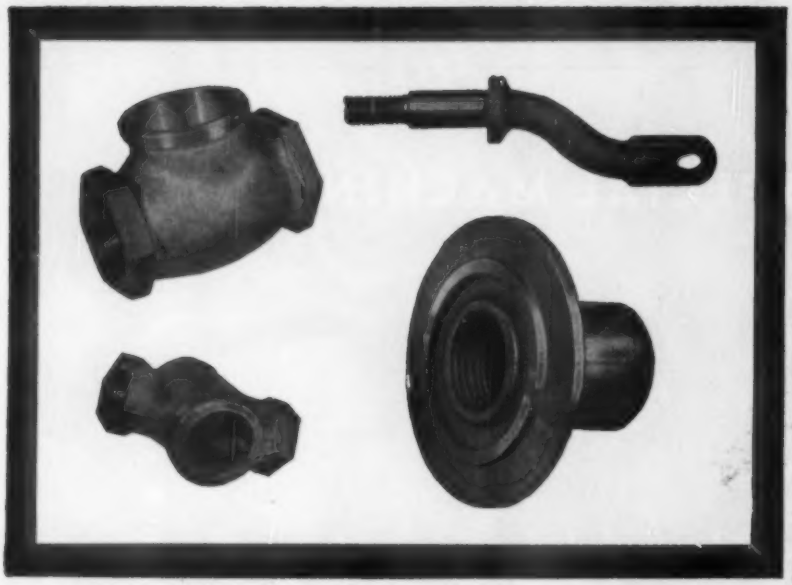
HYDRAULIC
INDEXING TABLE
MACHINE
TYPE R8-33
with 8 stations
and 33 spindles

Output:
350
components
per hour





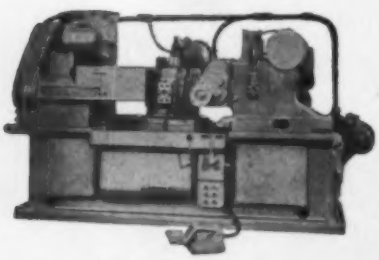
LUDWIGSBURGER
MASCHINENBAU
GMBH
LUDWIGSBURG/WURTT.
GERMANY



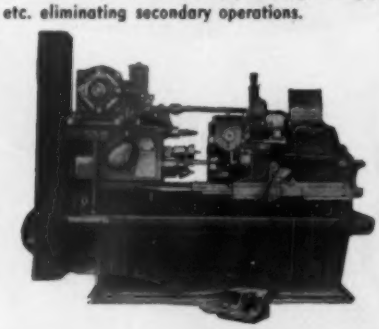
PARTS LIKE THESE and MANY OTHERS ARE BEING PRODUCED

with speed, convenience and economy...

on **GOSS & DeLEEUW AUTOMATIC CHUCKERS**



THE "ONE-TWO-THREE" 7-SPINDLE TOOL ROTATING CHUCKING MACHINE can complete in one operation as many as three ends of valve bodies, plumbing fittings, etc. eliminating secondary operations.



4-SPINDLE TOOL ROTATING CHUCKING MACHINES, available in three sizes, combine various turning, boring, facing, threading, multiple drilling and tapping operations on a wide range of single-ended parts.

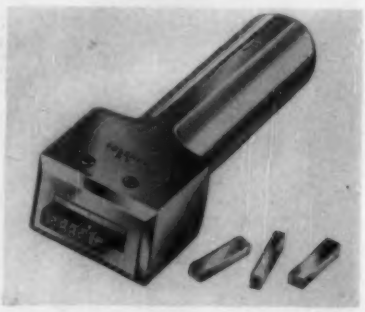
Send samples of your work for time estimates. Ask for illustrated literature.

GOSS and DeLEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

neered to JIC standards, and incorporates improved circuitry.

Applications include engine and vertical turret lathe controls; gear hobbing, hydraulic press, surface grinder, contour milling, threading and transfer feed press controls; continuous or batch-operation furnace panels. System illustrated is designed for semi-automatic operation of a multiple cylindrical grinding machine station.

Devco Engineering Inc, PO Box 387, Caldwell, NJ



DIE STAMP, called Time Saver, has specially hardened steel plate under the changeable type. Insert plate is made of company's Miracl steel, developed for stamp and die purposes. Available in 3 sizes, stamp can be used in hand or in a press—*Sossner Steel Stamps, 161 Grand St, New York 13, NY*

Dynamic balancing indicators, printed on self-sticking tape, are used on parts balanced with Gisholt dynamic balancers. Tapes are made to precision lengths with exact distance measured between numerals to insure accurate stroboscopic reading of the workpiece. Tapes are made of vinyl cloth and come on handy dispenser cards.

W H Brady Co, 727 W Glendale Ave, Milwaukee 9, Wis

Self-dumping hopper, 30 in. wide, for handling bulk materials, scrap, and waste through narrow aisles and in confined areas, has capacity of 10 cu ft. Mounted on three casters, unit can be pushed manually or transported by fork truck.

Roura Iron Works, Inc, 1401 Woodland Ave, Detroit, Mich

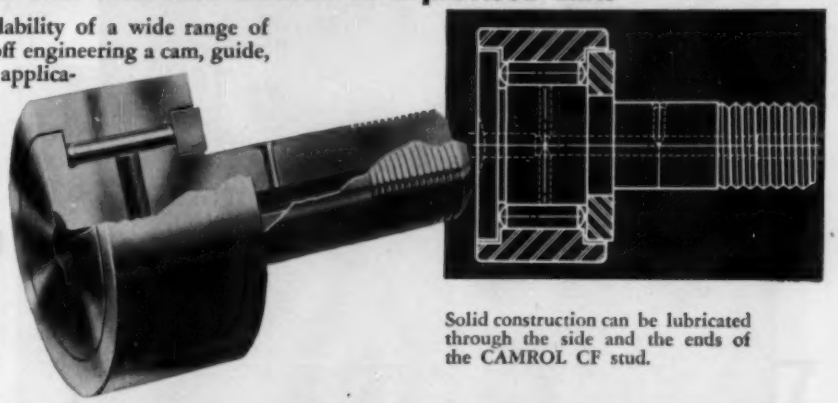
Finish stripper, Epoxystrip, removes paint, lacquer, enamel and many other finishes from metal surfaces. Manufacturer claims that material

BEARING TIPS by McGill

For convenience, with savings in time and cost

Use McGILL® CAMROL Cam Followers instead of improvised units

Simplification of design with availability of a wide range of standard bearings takes the strain off engineering a cam, guide, support or track roller bearing application. No need to "build up" a special unit when you can select the proper size standard CAMROL bearing engineered especially for the job. McGill's CAMROL bearing construction offers full type capacity, with provision for shock, in a compact precision unit. Specify CAMROL, the original cam follower, in either CF (with stud) or CYR (shaft mounting) series. Sealed and prelubricated bearing available also.



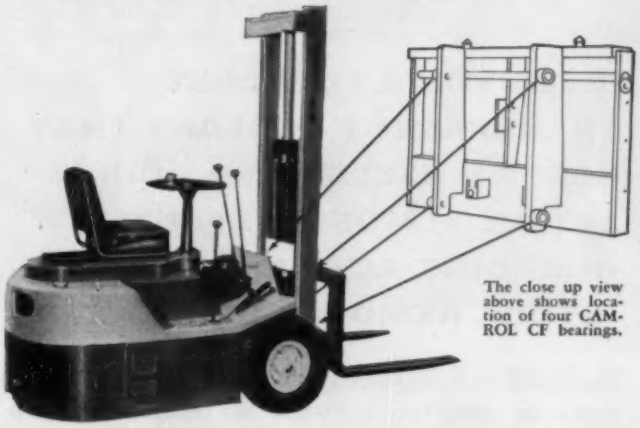
Solid construction can be lubricated through the side and the ends of the CAMROL CF stud.

CAMROL YR bearings help F-100 Super Sabre make slower and safer landing

The supersonic speeds obtained by today's modern aircraft set up design problems not encountered with older, slower planes. The overall streamlined design required for speed in flight, for instance, necessitated finding ways of supporting the North American F-100 Super Sabre at low air speeds required for landing. A

series of slats on the leading edge of the wing, providing greater lift at lower air speed, was the answer. Each slat is supported by McGill CAMROL YR bearings — especially designed to permit shaft or yoke mounting. These long-life bearings carry the loads of these slats as they move on tracks during flight of the Supersonic F-100.

CAMROL CF bearings out-perform friction rollers as fork support bearings



The close up view above shows location of four CAMROL CF bearings.

Small size and high load-carrying unit construction with simplified lubrication are among principal benefits obtained by Hyster Company from use of CAMROL CF bearings as fork support rollers in its Hyster 20 and other lift trucks.

Two bearings ride up and down inside each vertical mast section to position the lift truck fork under load. Speeds are relatively slow but the crushing loads on each bearing are heavy.

In this particular application, the exterior surfaces of the bearings are treated with a black oxide finish. This provides corrosion-resistance which serves to augment maintenance-free operation, a characteristic of CAMROL bearing construction.

Fact-packed Bearing Catalog

Write for your copy of Catalog 52-A, a revised, 128-page Bearing Selection Guide.

Insure performance with McGILL®

MULTIROL® GUIDEROL® CAMROL
Precision Needle Bearings

McGILL MANUFACTURING COMPANY, INC., 300 N. LAFAYETTE ST., VALPARAISO, INDIANA

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W+B
Grinding Concentrate 1500
in 150 parts water

GIVES YOU A LOW-COST, TRANSPARENT COOLANT THAT KEEPS WHEELS OPEN • CHIPS SETTLE ALMOST INSTANTLY
•GRINDING ACTION IS KEENER
•STOCK REMOVAL IS CLEANER

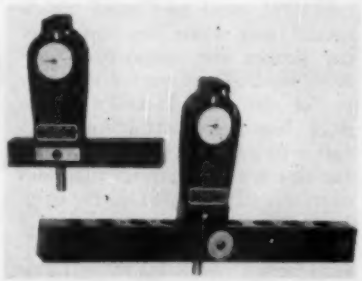
Our files are bulging with case-history proof of the success that many plants have had when they changed to W & B Grinding Concentrate 1500 for grinding ferrous metals and titanium.

Pick up your phone or use the postage-paid reply card that is bound into this magazine to get job-proven information about this entirely different type of grinding coolant that was *developed for you by the company that originated grinding lubricants!* It's smart to improve *your* production by taking advantage of W & B's 69 years of experience and know-how!

W+B INDUSTRIAL LUBRICANTS
THE WHITE & BAGLEY CO.
Worcester, Massachusetts • Detroit, Michigan
Originators of Grinding Lubricants

will, if applied properly, outstrip any other product now on the market, and will do so without removing or damaging the bonderizing or phosphate coating.

Beck Equipment Co, 3350 W 137th St, Cleveland 11, Ohio



INDICATOR DEPTH GAGES may be assembled from interchangeable parts. By selective variations of components over 3500 standard depth gages may be specified to gage special dimensions. All standard models may be set to either gage blocks or a master set gage—*A G Davis Gage & Engineering Co, 21435 Dequindre Rd, Hazel Park. Mich*

Motor protecting relay, Esco Type TS, protects a 3-phase induction motor of any capacity and voltage against shaft overload, voltage unbalance, single-phasing, and undervoltage. Unit is guaranteed to "drop-out" the motor when any one or a combination of the above factors cause dangerous temperature increases.

Electrical Service Co, PO Box 1039, Greenville, Tex

Goggles, Model 440M, have wide-angle lens which fits over most prescription glasses. Shatter-proof lens is easily replaced, and is available in either methacrylate for heavy-impact protection or acetate for normal usage. These cover goggles are lightweight, fully ventilated, and are smaller than other goggles of this type.

Watchemoket Optical Co, Inc, 232 W Exchange St, Providence 3, RI

Protective covering, called Protecto-Mask, guards polished metals, and is now available in several grades: Standard grade covers aluminum, stainless, glass, and sheet plastic; black weather-resistant grade protects architectural products; fabri-

Tool Steel Topics

BETHLEHEM STEEL

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Air-Quenching Adds to Life of Hot-work Tools

Most hot-work tool steels can be hardened by quenching in oil or air. Because of convenience in handling, and in order to avoid excessive scaling, many hot-work tools are oil-quenched. However, air-quenching is better practice because air-quenched tools have lower residual stresses than tools which have been liquid quenched. Since heat-check failures develop from surface stresses produced in service, the presence of residual stresses in the tool itself can lead to premature failure. Tools with low residual stresses are best suited for long service life on hot-work applications. That's why air-quenching is usually considered the most practical procedure for hot-work tools.

INJECTION MOLD OF DURAMOLD B

Pops Out Plastic Poppit Beads

This injection mold, containing 120 cavities, is used in an 8-oz injection machine to produce one size of the popular polyethylene Poppit Beads. The mold is made of Bethlehem Duramold B tool steel, and was produced by R. A. Koegl Stamp & Die Works, Hillside, N. J., from steel supplied by Ackerlind Steel Co., Inc., New York.

Duramold B is an oil-hardening, chromium-type of plastic-molding die steel, with an addition of boron. In heat-treatment, it develops a surface hardness of Rockwell C62.

Duramold B is ideal for long service life because of its high core-strength and resistance to wear. Toolmakers are sure to like it because it can be annealed to a hardness of 100 max Brinell, which permits easy cold hobbing, even where deep or large cavities are used.

Typical Analysis

Carbon 0.07	Manganese 0.30
Silicon 0.15	Chromium 1.00
Molybdenum 0.25	Boron added

To order a trial piece of Duramold B, or obtain detailed information about this or any other grade in Bethlehem's complete family of tool steels, simply get in touch with your Bethlehem tool steel distributor.

Putting the Bite in Chisel Steel

At Stanley Tool's Atha Plant, Newark, N. J., dies of Bethlehem Lehigh H tool steel are used in trip hammers of this type to forge cold chisel blades. Lehigh H, our special-purpose high-carbon, high-chromium grade, is ideal for this type of application because of its excellent wear-resistance and adequate red hardness.

If you keep performance records on your broaching tools, you have learned that those good

LAPOINTE -BROACHES

- last longer between grinds because they have a finer finish
- permit more re-sharpenings during the life of the broach because of the Lapointe-quality steel
- are properly designed and accurately made.

What price broaches? Most production men know that broaching is the *fastest and most economical method* of removing metal. The initial cost of the broach becomes insignificant when the overall results are properly analyzed . . . a long, fast production run, *with no rejects,* pays off every time when you use *good broaches* — LAPOINTE BROACHES!

Send for a valuable FREE MANUAL "how to care for BROACHING TOOLS"

A copy will be forwarded immediately on request. Ask for BOOKLET No. 2.

LAPOINTE-BROACHES, *Electrolized* increase broach life between grinds from 2 to 10 times.

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THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

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NEW SHOP EQUIPMENT

cating grade which can be drilled and cut; and heavy-duty grade which can also be used for sand-blast masking.

Mystik Adhesive Products, Inc, 2635 N Kildare, Chicago 39, Ill

Self-sticking labels, designated Write-On, take pen, pencil, ball-point, or typewritten information, and will stick to any clean dry surface. Labels are available in vinyl cloth or aluminum foil, in sizes from ¼ x 1½ in. to 1½ x 1½ in.

W H Brady Co, 727 W Glendale Ave, Milwaukee 9, Wis

Floor cleaner attachment is a magnetic head which attaches to any of company's Model E-54M-2 or G-54M-2 Floormobiles. Magnet mounts just behind pickup nozzle and reportedly is capable of lifting 3 or 4 lb. Bulletin 571.

Handling Devices Co, Inc, 43 Pearl St, Brookline 47, Mass

Safety glasses feature modern frame design, are rigid, and will retain their shape without bowing. Glasses are available in two colors, opaque slate or translucent flesh, and three sizes, No. 375, 44 x 37 mm; No. 376, 46 x 39 mm; and No. 377, 48 x 41 mm.

Chicago Eye Shield Co, 2329 Warren Blvd, Chicago 12, Ill

Engraving coolant called Engravolube is supplied in squeeze bottle, and is specially formulated for cutting on hard materials such as stainless, nickel-chrome, bronze, brass,

"Why, thanks, sir. I'm sure this friend of yours is an excellent divorce lawyer and all that. But what I meant when I said I couldn't support my wife on what you pay me wasn't exactly —"

monel, and cast iron. Material, which is said to give a smooth, bur-free cut, is also recommended for drilling, tapping, milling, and broaching.

New Hermes Engraving Machine Corp, 13-19 University Place, New York 13, NY

Die heads, DD Series, for hand machines are now available with aligning shanks having the same features as the DS and DSA die heads (*AM*—Mar 25 '57, p194). Feature provides for properly aligning the die head with the work to be threaded. Heads can be supplied with flanged or straight shank.

Greenfield Tap & Die Corp, Geometric Tool Co Div, New Haven 15, Conn

Gear lubricant, Plastigear-X, will not melt or freeze, and is not susceptible to water or extreme pressure. Company claims that only one-quarter as much grease is needed as before. It can be applied by hand or by gun, and is recommended for open gears, chain, wire rope, and cable.

Warren Refining & Chemical Co, Cleveland, Ohio

Slide chart on machining of stainless steels gives concise data on turning, drilling, tapping, threading, milling, and reaming operations. Pocket-size chart tabulates speeds and feeds, shows relative workability of various steels in operations such as blanking, deep drawing, stamping, forging, heading, roll threading, and welding.

Carpenter Steel Co, 309 W Bern St, Reading, Penna

"I've tried to keep it up with a few parts I bummed out of the machine shop . . . of course it runs like a combination lathe and grinder now."

HOW TO GET ALL THE ADVANTAGES FROM THROWAWAY TOOLING

Many plants lose a good part of the potential benefit in their throwaway tooling programs. But the lost advantages can be regained by using MicroDex inserts. They are processed by a new technique to give you a 25% gain — or more — in throwaway tooling efficiency.

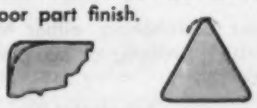
BELOW ARE THE FEATURES REQUIRED IN AN INSERT FOR PEAK THROWAWAY TOOLING PERFORMANCE:

DIMENSIONAL ACCURACY — You want, of course, to be able to index or replace an insert and get the machine under way again without resetting the tool or taking trial cuts. So, dimensional requirements must be far more rigid than formerly thought necessary. (On turning, for example, an insert error is doubled on the part.)

Corner angles must be right — Radii must be accurate and equal — Turnover inserts must have square sides

Valenite **MICRODEX** inserts are ground by an exclusive new method to give you the most accurate inserts obtainable.

TRUE RADIUS TANGENCY — Corner radii must be truly tangent to the sides. If not, the insert will cut on a sharp point. This reduces insert wear life and makes for a poor part finish.



Valenite **MICRODEX** corner radii are always perfectly tangent to give you better throwaway service.

FINE SURFACE FINISH—A good micro finish on the insert is essential if you want smooth cutting, good part finish and long insert life.

Compare **MICRODEX!** Fine finish is a bonus advantage of the MicroDex processing technique.

PREMIUM QUALITY MATERIALS— Processed by advanced methods in the world's finest carbides plant, only the choicest raw materials are used in MicroDex inserts. Yet you pay no more for them than for other inserts!

PROVE IT FOR YOURSELF!

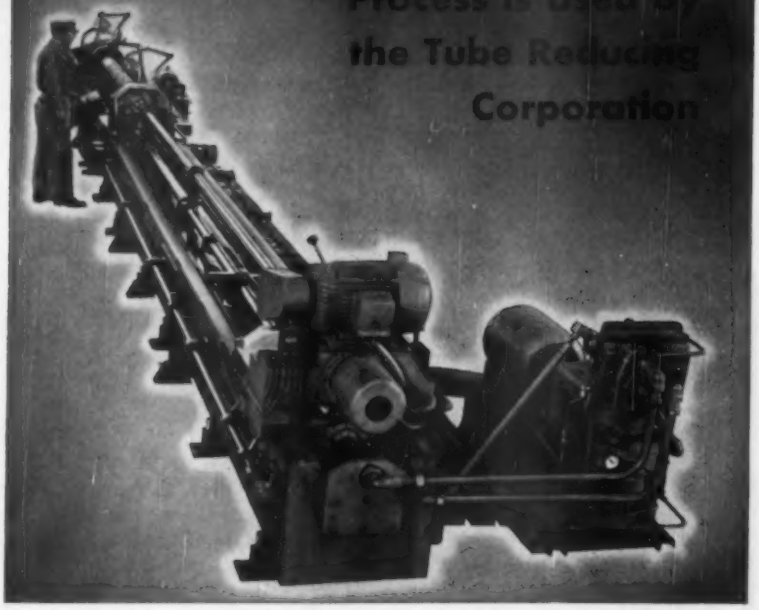
1. Before approving any inserts for use in your plant, check their suitability with the Valenite insert checking kit. (Consists of comparator fixture, dimensional templates for all standard squares, triangles and diamonds.)*
2. Run a side-by-side comparison of insert life, machine downtime, part accuracy and finish using MicroDex inserts and any other inserts. Then specify the insert that gives you more of the advantages inherent in throwaway tooling!

***For complete information write to Valenite's Technical Services Dept. Request Catalogue B.**

VALENITE® METALS
DIVISION OF THE VALERON CORPORATION

BOX 205
ROYAL OAK, MICHIGAN

Why MICROHONING Process is Used by the Tube Reducing Corporation



The carbon steel, stainless steel, alloy steel and non-ferrous tubes manufactured by the Tube Reducing Corporation are used on applications that require high strength, uniform wall thickness and surfaces free of pits, scratches or other imperfections.

In processing its tubes, Tube Reducing uses Microhoning, either to prepare the tubing for its exclusive "Rockrite" process, or to generate functional characteristics in finished tubing.

As a preparatory operation—which produces a round, straight bore and a clean-cut, cross-hatch surface pattern—Microhoning helps to improve the results of "Rockriting." The Microhoned surface slides easily over the "rocking" mandrel and compresses to a smooth, flaw-free surface that passes the most rigid inspection and tests.

Other "Rockrite" tubes, used in such applications as hydraulic cylinders, are Microhoned after "rocking" to generate final bore size and geometric accuracy.

The principles and application of Microhoning are explained in a 30-minute, 16mm, sound movie, "Progress in Precision"... available at your request.

☐ Please send me "Progress in Precision" in time for showing on_____(date).
☐ Please have a Micromatic Field Engineer call.
☐ Please send Microhoning literature and case histories.

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MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

Round Table...

EXECUTIVE FOREMAN

How "executive" should a foreman be? Where is the line between availbility and leadership? If he makes himself always available for questions and worker-guidance is he downgrading his own position?

Two of the toughest executive problems today are how to keep up with a mounting workload and how to delegate more routine jobs. To help foremen and other executives clear the decks for more action, one of the most effective techniques is a simple review of executive methods and procedures. Half the battle may be won just by putting your finger on the specific problem which, in many instances, is a failure to delegate authority to subordinates for taking care of details. If the foreman or executive will take time to evaluate his methods of work he should also check to see how much paperwork he can eliminate, simplify, or turn over to this staff, and devise a system for making sure he tackles the most important jobs first.

The foreman who is truly an executive has learned to take full advantage of the talent, information, and know-how among his own staff. He not only gets his subordinates to handle the clutter of paperwork that devolves on executive administration of a department, but he also

"The only cure I know for that is pretend like Mondays are Fridays!"

lets his group leaders do all the training and advising of the workers. The foreman is available for major decisions and important questions concerning administration of his department. In other words, he is making it work for him instead of working himself into a breakdown trying to take care of the multiplicity of details that comprise the day-to-day functioning of a department.

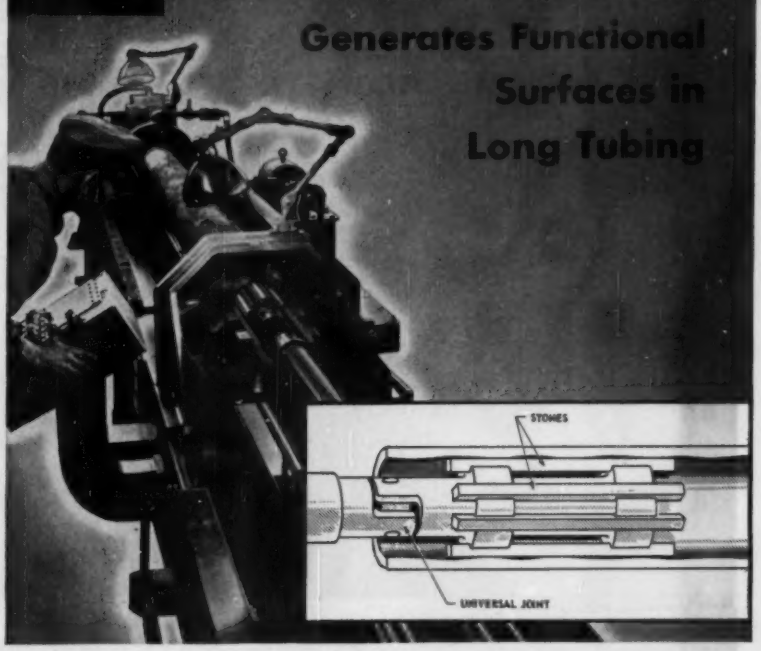
The foreman who finds himself in a quagmire of paper work and is continually bogged down with petty details should take a critical look at the method of performance of his own job. Since every foreman has to depend on the people he works with to carry out his programs and policies, he may find it helpful to take a fresh look at the methods he uses in dealing with his people. For example, Mr Foreman, do you ever give qualified people in your department a crack at certain jobs—even though they've never handled them before—instead of trying to do them yourself? Do you try delegating authority to your assistants, and praise individuals who do particularly fine jobs? Do you take steps to develop initiative among your assistants and subordinates by giving them authority to issue their own instructions, standing firmly behind them, and discussing mistakes constructively?

No executive can hope to be successful and remain that way unless he sets up a chain of command, delegates authority to subordinates, and shows confidence in their ability. There need be no fear that an executive foreman will lose control of his men when he gives his subordinates a chance to help carry out the plans of the department and makes them responsible for their efficient execution.

There is an art in getting subordinates to assume obligations. And in the exercise of this art there is a by-product—the making of a better executive as well as a subordinate. The wise foreman knows that his own personal progress as an executive is inextricably bound to the improvement and accomplishments of his subordinates. The foreman can be a true executive when he has a sincere and unselfish interest in helping his subordinates to improve. For this he needs a complete understanding of the individual to whom he is delegating authority.

Everywhere today the pressures on management are steadily increasing, making it more important than ever to have supervisors who can stand on their own feet. In every company which has been successful in building responsibility down the

How MICROHONING Generates Functional Surfaces in Long Tubing



Microhoning is used by the Tube Reducing Corporation in processing many types of tubing that range up to 18 feet long and 9½ inches in diameter. The tubes are Microhoned on a horizontal Hydrohoner equipped with a hydraulic clamping fixture that is easily adjusted to handle tubes of various sizes.

Microhoning tools have long abrasive sticks which cannot follow irregularities in the bore. The abrasive action removes high spots while generating required surface characteristics and accurate geometry. A universal joint, connecting the tool body to the drive shaft, eliminates any tendency of abrasive action to change the bore location.

Typical processing of "Rockrite" tubes: To remove scale and deep scratches . . . hot rolled, pierced billets are first bored. Then, the bores are Microhoned—stock removal rate is .015 inch from a 4½-inch diameter x 128-inch length in less than 30 minutes. The Microhoning operation generates accurate, round, straight surfaces with the required finishes of 20 to 30 microinches r. m. s.

Send coupon for complete information.

Learn how Microhoning will give efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

☐ Please have a Micromatic Field Engineer call.
☐ Please send Micromatic literature and case histories.

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HOW OBSOLETE ARE *YOUR* MACHINES?

More than half-a-million machine tools and metalforming equipment units installed in the nation's metalworking industries are more than 20 years old. FROM THE SEVENTH AMERICAN MACHINIST INVENTORY OF METALWORKING PRODUCTION EQUIPMENT. Reprints at $1.00 each.

READER SERVICE DEPT., *American Machinist*
McGraw-Hill Building, New York 36, N.Y.

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INDICATING MICROMETER COMPARATOR
has the VISIBLE feel
No Arguments as to correctness of reading due to "feel".
Use it as Comparator, Master Micrometer, Go & No Go Gage.
.1" Range reading in 1/10,000"
To attain permanent accuracy at these close limits, highest precision workmanship and exclusive design of mechanism are of Major Importance and ONLY found in "MASTER COMPAR".
A RIGHT HAND TOOL
Release button for movable Anvils on RIGHT Hand side enables you to hold tool the conventional way.
NEW — Resetting to Zero in 5 seconds
Quick adjustable tolerance bands. Heavy TUNGSTEN CARBIDE Anvils will actually measure Out-of-Roundness, Ovalness and Taper.
8-1" SIZE IN HARDWOOD CASE
$105
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Ask for Demonstration
GEORGE SCHERR CO., INC. 200 AM LAFAYETTE STREET • NEW YORK 12, N. Y.

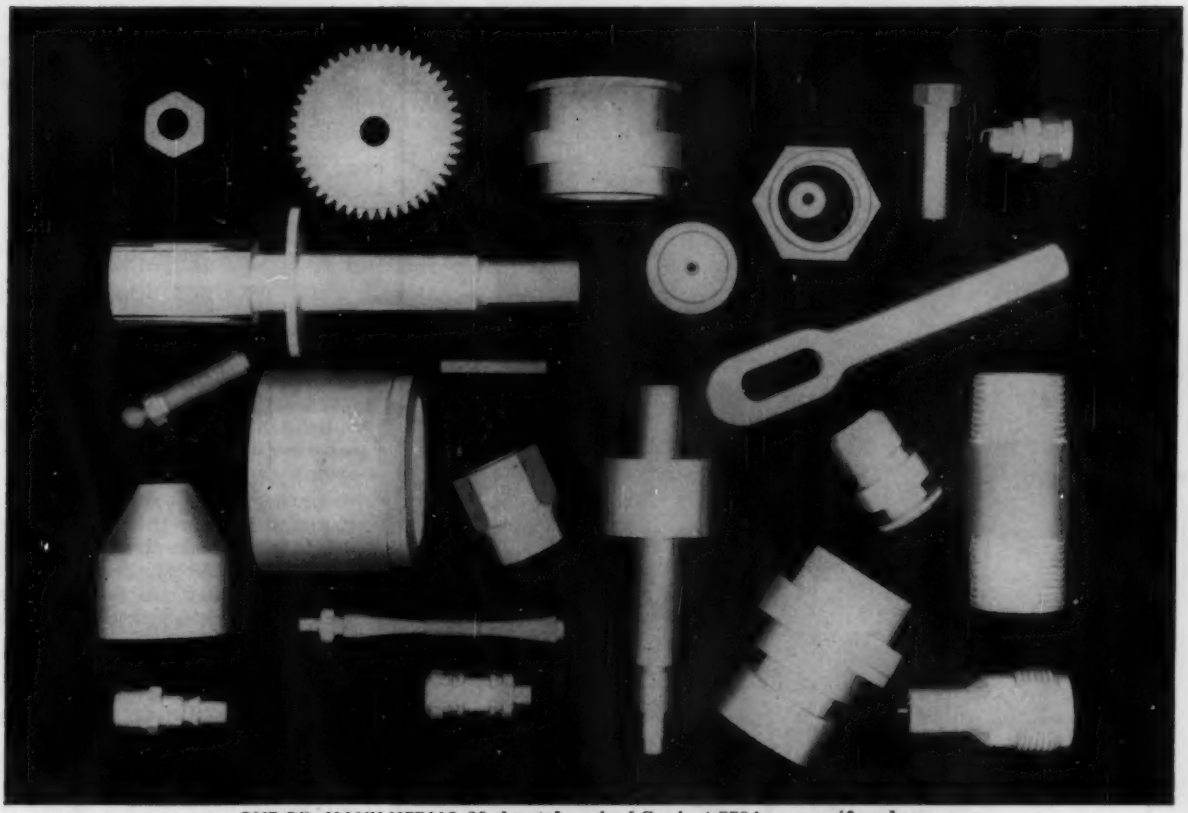
line, emphasis has been placed on the need for individuals making decisions and carrying them out.

To the foreman who would be an executive I would suggest: Never undertake what you can delegate; never do anything someone else can do better and faster. It's personal vanity, business folly, and time-wasting to imagine you have to do everything yourself. Above all, plan ahead on paper the things you have to do. Pencil-jotting and thinking through can often cut actual work time in half. And the top-notch foremen are usually those who follow a planned and relaxed, rather than an efficiency - decreasing, pressurized pace.

Today's foremen must be able to move surely from policy to action in situations that are different from anything experienced before. Technical progress is imposing new demands on the skill and ability of foremen. It is not hard to predict that the practice of management will be profoundly affected by the rapidly approaching forces of automation and statistical decision-making. While many of the quantitative aspects of the executive's job are going to recede into the innards of a computer, new problems will inevitably crowd in to take the place of the old ones. And a new standard of accuracy and precision will be called for in qualitative as well as quantitative judgments.

The first question a company must now begin to ask of its candidates for executive responsibility is: "What can you do that a computer can't?" In more and more companies, the decisive factor is going to be the

"Please, Boss, let me work the three weeks you're away on vacation—it's one of the few pleasures I have left."



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NEW SUNICUT 5534 CAN BE USED ON A WIDE VARIETY OF STEELS

SUNICUT® 5534 ends your search for a single cutting oil that can assure quality machining of a wide variety of ferrous metals...ranging from B1112 to 4130 and including free-machining stainless steels.

A non-emulsifying, transparent cutting oil, Sunicut 5534 can speed production of general screw machine and turret lathe work. It gives excellent finish in tapping, drilling, threading, and light stamping operations and can be used on many special jobs run at both high and low speeds.

Try moderately-priced Sunicut 5534. It can save you money by reducing your cutting oil inventories and oil change time. It can boost your production and profits.

For detailed information, prices and delivery data about this new, versatile cutting oil, call your Sun representative today. Or write directly to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AM-7.

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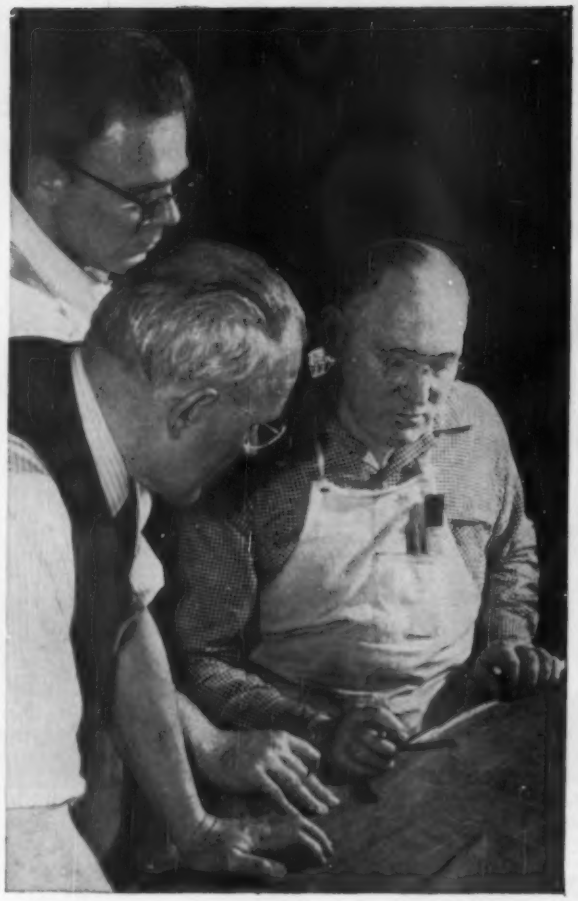


it's a job for CDT

Faced with a special tooling job? Stymied by a tough problem? Would 50 years of experience help? Then the logical answer for you is to send it to Columbus Die-Tool! CDT specializes in tools, jigs, fixtures and also special machinery, designed and built to produce your products better, faster, and more economically.

That's why so many of the nation's leading manufacturers avail themselves of the specialized services of Columbus Die-Tool. Perhaps CDT can solve your tooling problem and help you make your product . . . better for less.

Columbus Die-Tool
AND MACHINE COMPANY

P. O. BOX 750 • COLUMBUS, OHIO
ESTABLISHED 1906

Designers and manufacturers of JIGS • FIXTURES • SPECIAL TOOLS • UNITS FOR MACHINE TOOLS • *also Builders of Machine Tools Complete*

breadth and depth of executive judgment on an executive basis will be lacks the judgment to run his department on an executive basis will be unable to keep pace with the demands of modern management.

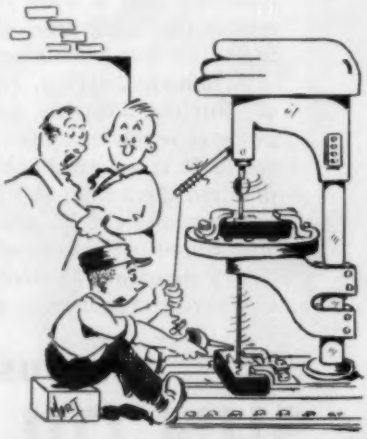
Harry Kaufman
Philadelphia, Penna

TROUBLE BOARD

What's the best way to give the breeze to a complaining worker who's been stung buying something listed for sale on the department bulletin board? Should the company supervise notices put up on the board?

HANKS' SUGGESTION that the company should recompense him for making a bad deal in the purchase of a used car is so fantastic as to encourage me to believe the whole thing is a legpull hit at Al's worry weakness. In granting a convenience, by throwing the department bulletin board open to personal notices concerning the men's private affairs, the company is setting the men a high example in the art of industrial goodwill which, unfortunately, is lost on the type of employee personified in Hanks.

Al should not take seriously such a request. He should treat it with gentle scorn and mild parental sarcasm. On no account should he even appear to give it serious consideration. To do so would be merely to encourage Hanks in his stupidity, or should it be cupidity? Whatever the motive behind the claim, Hanks is possessed of a low-grade mentality



"Joe is getting ready to put a suggestion in the suggestion box."

and once that type gets settled in, ridding the plant of their unwholesome presence is quite a problem today. They stick like limpets and, with union backing, defy all attempts at dislodgment.

In this connection, one of my foremen was saddled with a near relation of Hanks. He pulled the wool over the eyes of Personnel by his ready smile and mock humility. His experience of interviews seemed to be peculiar and extensive. Personnel fell for him and in a few days the foreman fell out with him. As a mechanic he was sub plus, but he had a way with him, and in a short time he consolidated his position by getting himself elected shop steward. Then the fun began. He had two lightning strikes in as many months. Shop stewards had never been a feature of this particular plant which worked contentedly on a basis of live and let live and give and take. It was all "take" with our Hanks who eventually got the men to refuse piecework, on the plea of poor prices and facilities.

He *had* something regarding facilities but the plant worked happily before his advent and the men gave a good return for good money. The real reason for our Hanks' onslaught on piecework was that he was quite incapable of making a pay on prices that presented no difficulty to the others on the plant. It is common belief over here that the Hanks type make a point of getting into a union job so they can always shout "discrimination" or "victimization" if sacked for either inefficency or, indeed, for any reason whatsoever. It doesn't deter them if the reason is well proven. Unfortunately, union solidarity is never discriminatory; any dumb cluck gets the same "hands off" backing as those who earn their corn.

Should Al be allowed to fire the man if he bothers him excessively? It would all depend on how highly unionized the shop might be. If Hanks kept hammering away at Al to get the company to make good the loss he sustained in his dud-car deal, he would richly deserve to be fired and I feel sure Al would gladly pour out the medicine. In the circumstance, I am not so sure it would be quite wise to sack Hanks just for being a nuisance. If Hanks took his case to the union it might feel as I do. That could mean a trial of strength between the company and the union, for which the company would not thank Al. On the other hand, if Al took matters into his own

(Continued on page 172)

new FOR OPTICAL GAGING

MULTI-USE FIXTURE PROVIDES LOW COST STAGING FOR MANY SMALL PARTS

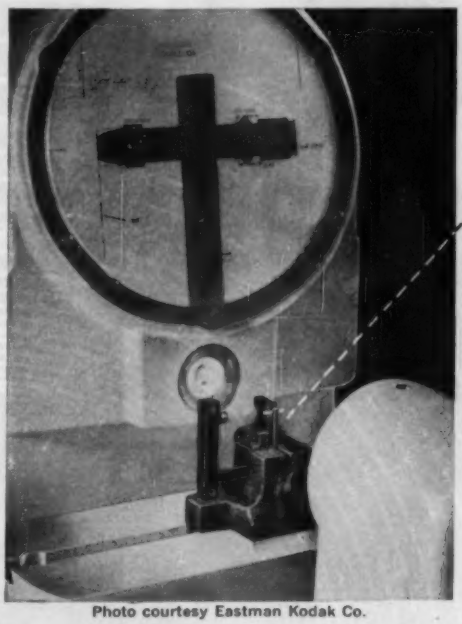
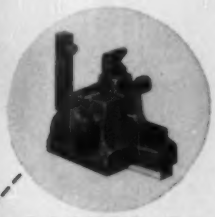
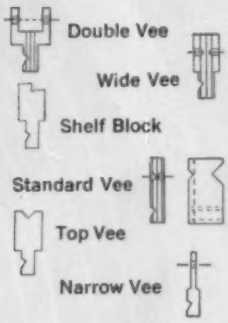


Photo courtesy Eastman Kodak Co.



O. G. P. Multi-Use Fixture fits all types of optical comparators.



O.G.P's NEW Multi-Use Fixture has replaceable part holders designed for holding many types of small parts. Standard holders in varying sizes and shapes are available (see drawings above). Quickly locks into keyway with clamp.

EVERYTHING TO MAKE YOUR OPTICAL COMPARATORS MORE USEFUL

We also supply all types of standard charts, custom charts, layout accessories, fixture bases, and custom fixtures to meet your specialized requirements.

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26 Forbes Street, Rochester, New York
I'd like more data on the NEW O. G. P. Multi-Use Fixture.

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DI-ACRO* ROD PARTER

Make several thousand burr-free cuts per hour in bar stock

Combination shearing-breaking action parts bar stock without burring and minimum distortion. Handles up to ⅜" round bar stock—square, rectangular, and hex shaped bar stock can be parted when machine is equipped with special die heads.

Material range is from hot rolled bar stock to stainless steel and other high alloy materials. The harder the material is the better it parts.

Long lasting die heads can be reversed before resharpening—can be sharpened many times. Standard cutting heads in No. 2 and power models have 10 graduated holes from 1/16" to 3/16"; No. 1 Model has eleven holes. Optional die heads for parting scaly hot rolled bar stock. *at no extra charge.*

Speed-Matic Gauge, an accessory on power model, enables machine to part off several thousand short pieces an hour. *Send us samples for test cutting or consult the Yellow Pages of your phone book for the nearest Di-Acro distributor.*

Hand operated model also handles up to ⅝" rods.

Di-Acro Power Parter with stock stand and Speed-Matic Gauge.

This ¼" stainless steel bar stock has been "parted" in a Di-Acro Rod Parter. Shiny edges show where rod was sheared, then fractured or "parted off." Will clear hole its own diameter.

*pronounced die-ack-ro

O'NEIL-IRWIN MFG. CO.
311 8th Avenue
Lake City, Minn.

di-acro PRECISION METALWORKING MACHINES

hands and fired Hanks, Harrison might feel obliged to repudiate Al's action. His last state would then be worse than his first.

No, Al must either silence Hanks by dominating him, telling him to look for a job elsewhere if he isn't satisfied or find a convincing reason for booting him out.

The method we employed with our Mr Hanks may be of interest. His foreman, painfully aware of his lack of skill, decided to make no allowance for that, since he was in receipt of the highest district rate. He kept him on a tight rein for a few weeks, recorded his many mistakes and notified him of them. He then put him on a fabrication assembly. When the several parts had been prepared for welding, Hanks, as was the custom, proceeded with the parts to set them in place for the welder.

Afer welding, the completed assembly was checked and found badly out. Our Hanks got his notice for poor workmanship and general unsuitability for the company's class of work. As was to be expected, he raised the cry of victimization and demanded a panel with a union executive present. He smiled and oozed humility throughout the inquiry, claiming, apologetically, that due account was not being taken of the effects of expansion and contraction on accuracy, due to welding. The union official nodded his approval, till the foreman pointed out that one displacement complained of amounted to six inches, rather beyond the scope of either expansion or contraction!

In order to rid themselves of the limpets who embrace unionism only to serve their own selfish ends and to protect their own unworthy skins, executives in union-ridden plants must walk warily. This is not a wholesale condemnation of trade unionism, as such, with which I don't agree. Like the curate's egg, it is good in parts. Very many shop stewards are honest, helpful, selfless men who see it as their duty to negotiate for peace and who regard a strike as a partial failure on their part.

Yes, Ed's advice is better, incomparably better. His ironic comment "What's the trouble now, Al, somebody lost something and wants you to find it?" is priceless, a scathing appraisal of Al's ability, or lack of it, to handle his men properly. Al's refuge in time of labor trouble seems to be "fire them." A confession of failure, a policy of despair. Ed's advice to treat Hanks rough is much sounder in the circumstances, but Al seems to lack resource and decision. Take the matter to Personnel? It's *Al's* job to straighten out Hanks. Listen to Ed, Al. Squelch Hanks yourself, don't pass the buck. If Hanks keeps nagging you, it's because you let him get away with it. Refuse to listen to him and tell him what you think of his scrounging habits. Put the onus on him, tell him to seek work elsewhere if he isn't satisfied. If he succeeds in irritating you, he's got you in the hollow of his hand. You cannot fire him merely for out-maneuvering you.

C Donald
Lanarkshire, Scotland

"Confound it! That new man is working backwards again."

DEVELOPMENT CORNER

If a shop wants to experiment in development work, how should it be handled? Should an independent department be set up? Is it fair to take a man away from a foreman to work on development, without replacing him?

THIS IS AN ERA of dynamic growth, and research and development are the keynotes of success. It is no longer possible for a company to remain static in its designs and its thinking and hold its position; it is now a case of "grow or go." Companies large and small have found it essential to improve their products and methods and to develop new and superior ones. Without definite planned action in this direction the most firmly entrenched company will find itself losing its markets to its competitors.

The company no doubt realizes these facts and has Hanson working on some new ideas. The foreman should take a cooperative attitude and not fight the plan. He should

(Continued on page 176)

"Greatest Value"
as applied to
Bridgeport
TURRET MILLING MACHINES
is no accident

And the reason for this universally descriptive term applied to "BRIDGEPORT MILLERS" is simply and briefly because, from base to turret, they are designed and built with "greatest value" the objective in their specifications.

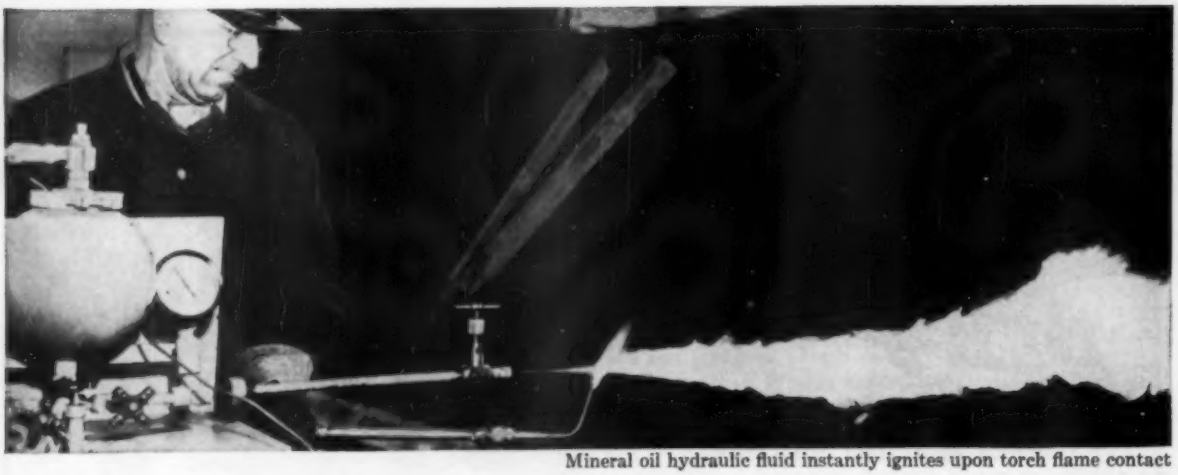
For example, precision is of highest order and components are held to closest tolerance to achieve this objective.

Then, too, with the "BRIDGEPORT", versatility contributes to "value" in that with these machines, milling, drilling, boring and shaping are operations handled at all angles of the work without changing set-up. And with the recently available True Trace Hydraulic Duplicator attachment, the "BRIDGEPORT" offers excellent performance and outstanding savings in time in copying such parts as irregular dies and moulds.

All these features have been tried and proved in day-to-day service in literally thousands of shops, large and small, because the "BRIDGEPORT" is within the reach of any and all shops who know "value" and modernize accordingly . . . with "BRIDGEPORTS."

Your nearest dealer will gladly furnish full information . . . or contact us direct.

Bridgeport MACHINES, INC.
Bridgeport Connecticut
Manufacturers of High Speed Milling Attachments and Turret Milling Machines



Mineral oil hydraulic fluid instantly ignites upon torch flame contact

Fire resistance plus low cost

FOR MANY YEARS frequent industrial fires involving hydraulic fluids have taken their toll in man-hours and high costs. This has created a widespread need for a relatively inexpensive all-purpose, fire-resistant hydraulic fluid.

In undertaking this challenge, Shell Research Laboratories spent over four years in laboratory and field testing before a solution was reached. The result was the introduction of Irus* Fluid 902 . . . the first low-cost, oil-base fluid that, under plant conditions, actually snuffs out fire.

The new formulation is a specific combination of petroleum oils mixed with water and emulsifying agents. It gains its fire resistance through a relatively high water content. Irus Fluid is perfectly adapted to the majority of hydraulic systems. The following is typical of many reports in Shell files.

Typical Problem and Solution

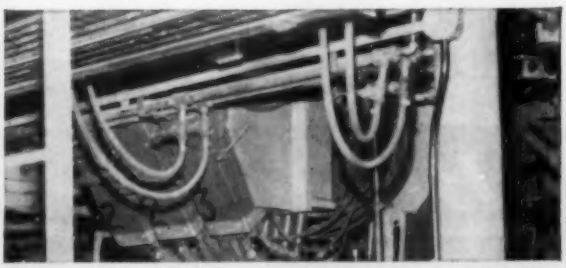
The welding plant of a prominent automotive manufacturer employing 100 hydraulically operated electric welders formerly used a straight mineral oil fluid. On one occasion, damaged fluid lines allowed this mineral oil under high pressure to spray directly onto the welding area. Sparks ignited the fluid . . . caused an immediate flash fire which resulted in 75% machinery damage before it was extinguished. Immediately following this incident, the changeover was made to Shell Irus Fluid 902. Shortly thereafter a line broke and the high-pressure spray once more contacted welding sparks. There was no fire at all . . . and in a matter of minutes the machinery was operating at full efficiency.

The two photos above provide dramatic proof of its flame resistance. In the photo on the left, conventional hydraulic fluid instantly ignites upon contact with an oxy-acetylene torch flame, whereas Shell Irus Fluid 902 (right photo), under the same conditions, does not support combustion beyond an inch or two from the flame. *Under plant conditions, it actually snuffs out fire!*

Two-Way Economy

An advantage not to be overlooked is the low cost of Irus Fluid 902. Many plant operators now making the

A leak is quickly spotted because of Irus Fluid's distinctive yellow color.



The complexity of cable lines necessitates the use of a fire-resistant hydraulic fluid to eliminate fire hazard.

Under the same conditions, Shell Irus Fluid 902 clearly demonstrates its fire resistance

in a new hydraulic fluid

switch to Irus Fluid find that it costs up to one-third less than other fire-resistant fluids—and its performance is comparable in every practical respect. This money-saving advantage is a vital consideration not only in the initial purchase price, but in reducing make-up loss expense.

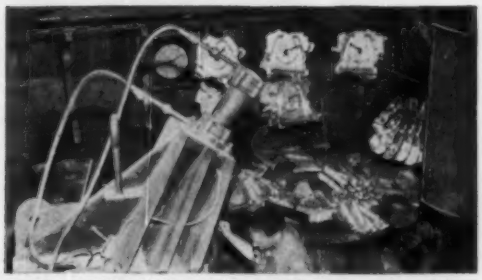
Irus Fluid 902 has other features, too:

1. **It contains no corrosive ingredients and has shown no harmful effects on normal seals, fittings, or bearings . . . it will not promote rust.**
2. **No major equipment modification is necessary . . . simply clean your present fluid thoroughly from the system and replace with Irus Fluid.**
3. **Practical application proves it has exceptional viscosity and lubricating qualities . . . doesn't thin out in use.**
4. **The yellow color of Irus Fluid enables you to spot and trace leaks easily . . . a valuable benefit in preventive maintenance.**

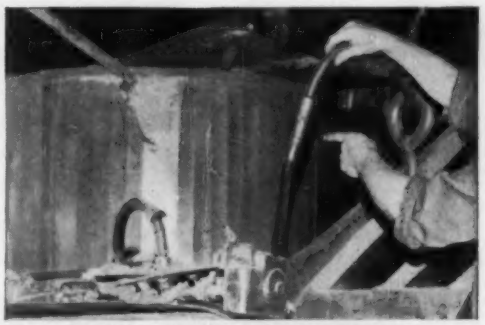
If your operation utilizes die-casting machines, plastic molding machines, glass blowing machines, permanent mold machines or any other hydraulic equipment where fire hazards are of concern, we suggest you investigate the advantages of Shell Irus Fluid 902.

Write or call the Shell Oil Company office nearest you.

*Trademark



Such specialized die-casting machines require a fire-resistant hydraulic fluid to assure maximum safety.



Finger points to line break in hydraulic cable that caused flash fire and machinery damage while operating with mineral oil type fluid.

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is preferred
when comparison
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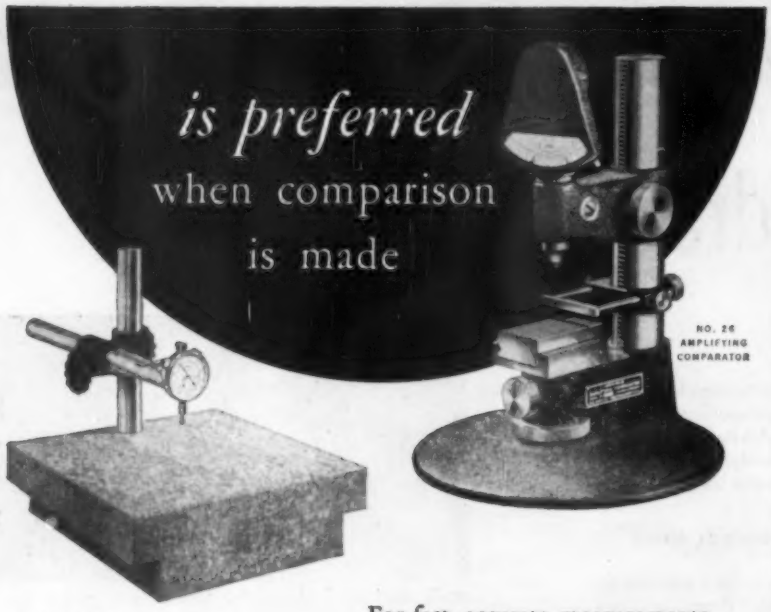
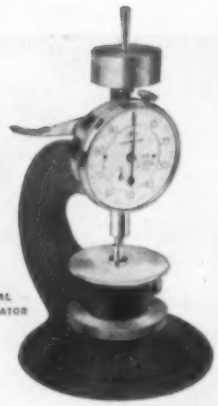


MODEL 130 GP.



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Special comparators are available for measuring resilient materials such as rubber, paper, etc., and for measuring non-yielding materials such as sheet metal, glass and plastic. Write for complete details.

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offer his assistance and perhaps his experience and ability will prove of value in this work. The enlightened foreman, aware of the value of research, will not hesitate to aid such a program. He can grow and advance most rapidly in a company which is progressive and expanding. The very help he gives to the development of a new idea may result in an increase in the size of his department or in his promotion to a new department to produce the new item.

In financial circles one of the most important factors used to determine the true value of an investment is the growth prospects of the company. The usual techniques for comparing growth prospects of companies is to make a comparison of the percentage of earnings spent on research. After all there are really very few monopolies and, in general, markets are open and all sellers are welcome. The new competitor who beats the going prices is greeted with pleasure by the purchasers.

The foreman should realize that he and his department do not function as an independent little unit, devoid of all connections and responsibilities to the rest of the plant. If the company goes under, he goes under too, no matter how well he thought he did his job. If he had a clear view of the over-all picture he could see the real value of development work and would make every effort to assist and cooperate.

William Martin
Brooklyn, NY

WHO BUYS THE TOOLS?

Should the company be responsible for all tools, including those owned by the workers? Is it the company's responsibility to replace stolen tools, if the theft takes place in the shop?

EASY COME, easy go. A man places a higher premium on his possessions if he pays for them out of his own pocket. That is one reason why wealthy children are taught to earn a living. It raises their sense of values and prepares them to form habits of responsibility.

If a worker is directly liable for something, careless handling is minimized, and he becomes more appreciative of company property when it is at his disposal.

A good craftsman takes pride in doing his job. If he knows that

the work has been done with his own tools, it gives him an added satisfaction because he gave the job a little more of himself. The end product will be just that much better because it has more of a personal touch.

If a firm really feels that the tools are its own responsibility, the payroll department should include their cost in the employee's paycheck. That would relieve the workers of the financial burden and yet the private ownership would still be retained.

Neal A Mack
Belle Harbor, NY

IN EVERY shop I've worked in the employees bought their own tools. This includes scales, protractors, feelers, thread gage, calipers, one-inch micrometer and all other tools that fit into the average toolbox. The company usually supplies all micrometers over one inch, as well as taps, dies, drills, and their holders.

Each man is responsible for his own tools. If the employee values his tools he locks them up after work. Very often wrenches are mislaid, and turn up later, sometimes in another department. I don't see how the employee can expect the company to replace these wrenches that have been handled carelessly.

I personally would prefer my own tools, close at hand, at all times. An employee should not have to run all over the shop to find the tools he wants.

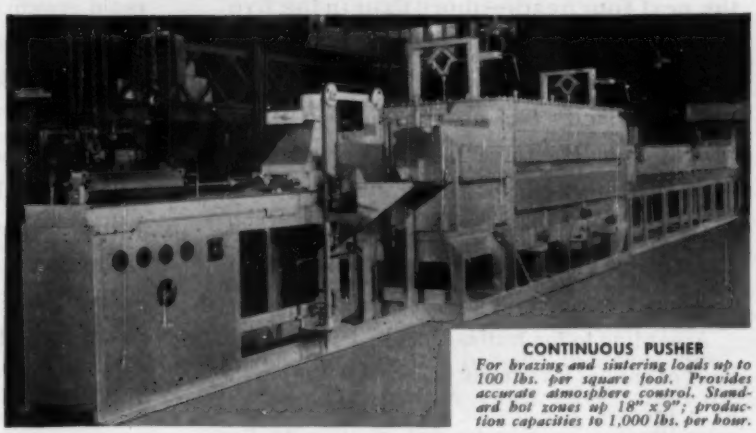
A E Salmons
Norristown, Penna

"I wonder which came first—the machine tool or the machine tool machine."

HARPER CONTINUOUS BRAZING AND SINTERING FURNACES

give you { PROCESS FLEXIBILITY
PRODUCT UNIFORMITY
HIGHER PRODUCTION

CONTINUOUS MESH BELT
For brazing and sintering loads up to 10 lbs. per square foot at 2100°F. Adjustable speed. Belt widths to 24", charge heights to 12"; production capacities to 550 lbs. per hour.



CONTINUOUS PUSHER
For brazing and sintering loads up to 100 lbs. per square foot. Provides accurate atmosphere control. Standard hot zones up 18" x 9"; production capacities to 1,000 lbs. per hour.

If these are the three major qualities you want in a controlled atmosphere brazing or sintering furnace, you will find them in a Harper Electric Continuous Furnace. Process flexibility is the result of multiple zone heat control, variable speed drive, and properly applied control instrumentation.

Once the desired conditions have been established, you will obtain complete product uniformity. Conditions outside the furnace being equal, your brazed joints or sintered compacts will be identical hour after hour, week after week.

You will get up to 50% higher production from a Harper Electric Furnace with silicon carbide elements* than from comparable size furnaces using other elements. Another important advantage of these high-power elements is that they can be replaced in an emergency without complete shut-down.

Consider the brazing or sintering furnace designed for production. Write for further information today to Harper Electric Furnace Corp., 33 River Street, Buffalo 2, New York.

*Nickel chromium elements also available for lower temperature changes.

HARPER ELECTRIC FURNACES
For Continuous Brazing, Sintering, Wire Annealing, Bright Annealing, Annealing, Forging and Research

What Research Means to American Business

American industry plans to invest $150 billion in new plant and equipment during the next four years—more than in the five years 1952-1956. It plans to carry out this record investment even though manufacturing capacity has nearly doubled since World War II. These facts are reported in McGraw-Hill's tenth annual survey of Business' Plans for New Plants and Equipment. They contradict many long-established theories about investment in capital goods.

According to the textbooks, a high and rising level of capital investment is generally followed by a decline. The bigger the rise—so the old theory goes—the bigger the decline will be. But, after a decade of high-level investment and an especially strong rise in the past two years, industry now has plans to keep right on with near-record outlays for plant and equipment. Does this mean some new factor has been added, to change the investment cycle?

The New Factor—Research

The latest McGraw-Hill survey points out one new factor which, more than any other, is changing the nature of the investment process. This is the record outlay planned by U.S. corporations for **scientific research and development**—to create new products and develop new industrial processes. The rapid growth of research in industry, and plans for even more remarkable growth in the years ahead, are shown by the accompanying table.

This year industry plans to spend $7 billion on research and development—up 20% from 1956. By 1960 it will spend $9 billion—enough to create a major new industry.

By 1960 manufacturing industry expects sales to be up 26%—with half the increase in products that were not made in 1956.

Growth of Research and Development Expenditures

(Millions of Dollars)

			PLANNED	
	1955	1956	1957	1960
Machinery	408	506	577	704
Electrical Equipment	950	1,149	1,310	1,637
Aircraft and Parts	1,038	1,558	2,274	3,161
Fabricated Metal Products and Ordnance	134	165	174	210
Professional and Scientific Instruments	185	252	300	453
Chemicals	440	498	528	617
Paper, Rubber, Stone, Clay and Glass Products	149	174	196	233
Petroleum Products	171	205	225	277
Other Manufacturing	1,038	1,279	1,388	1,557
Non-manufacturing industries	254	310	347	419
ALL INDUSTRIES	4,767	6,096	7,319	9,269

What Research Is Doing

Here are some examples of how industrial research is opening up new markets, or compelling the modernization of old facilities:

New automatic controls in petroleum refining will raise the quality of gasoline and reduce the time required for production. A new process for recovering oil from depleted wells promises to multiply our potential reserves.

A new process for treating iron ore will permit the ore to be fed directly into steel furnaces—without the need for blast furnaces or coke ovens.

New turbine engines—made possible by the development of heat-resistant alloys for turbine parts—offer greatly increased power for aircraft, ships and automobiles.

Altogether, industry plans to introduce more new products in 1957-1960 than in any previous four-year period. It also plans new processes on a scale that will make much of our present capacity obsolete. These new products and new processes are the secret behind continuing plans for high investment.

One-third of all manufacturing firms are building new plants this year to produce new products, and by 1960 this may account for 10% to 20% of all capital expenditures. At the same time, manufacturing companies report that over half their capital expenditures in the next four years will be for modernization of equipment and introduction of new processes. Thus the preponderant share of new investment will be based on developments growing out of research.

A New Kind of Prosperity

The keen interest of U. S. business firms in scientific research points the way to a new kind of prosperity for our economy—a prosperity based on deliberate creativeness. As long as we can create new products that will offer better value to consumers or cut costs to manufacturing firms, business will continue at a high level—not at fever pitch, perhaps, and it is to be hoped not at an inflationary pitch. But based on a steady stream of new products and processes, we can have a high level of general prosperity that defies the old laws of boom and bust.

It's Not Automatic

Of course, there is no guarantee. New products do not spring up by magic as the medieval alchemists hoped they would. They are found as the result of long and expensive effort in laboratories and pilot plants. This effort requires an increasing number of trained scientists and engineers. In 1957 alone, manufacturing companies report they will need 7% more of these highly trained people in research and development. And by 1960, they will need an additional 15% to carry out planned research programs.

The effort to maintain prosperity — as well as the national defense effort — will depend increasingly on this supply of scientific and technical personnel. But if we can supply the people, industry now has the plans for a research effort that will put an end to the spectre of idle plants and idle workers.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nation-wide developments. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw
PRESIDENT

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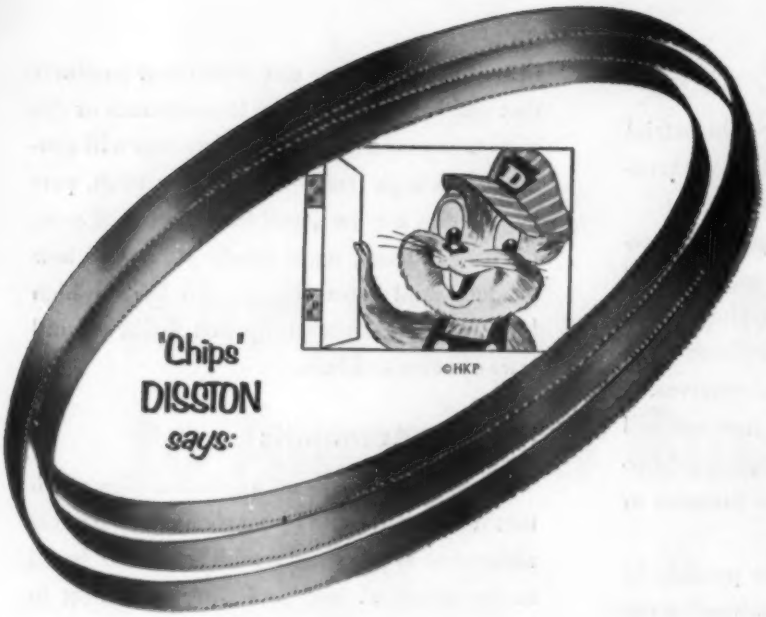

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Does your work call for close tolerance cutting . . . fine edge-holding qualities . . . good finish? Disston Metal Cutting Band Saws give you all that and more —*long, long blade life!*

LANCER TOOTH—Hard edge blade with positive rake angle tooth. Permits high-speed production cutting of non-ferrous metal, wood and plastic. Cuts brass and aluminum solids and Plexiglas with equal ease.

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HKP Henry DISSTON DIVISION
H. K. PORTER COMPANY, INC.

Names in the News . . .

Kenneth W Brown has been appointed manager of the manufacturing department of Boeing Airplane Co's pilotless-aircraft division, Seattle, Wash. He was previously industrial engineering manager of the company's Wichita Division.

R Bruce Foster has been named chief application engineer for Sundstrand-Denver Division of Sundstrand Machine Tool Co, Rockford, Ill. He was formerly associated with Bell Aircraft Corp, Buffalo, as chief preliminary design engineer of the Rockets Division.

Keith N Stought has been promoted from assistant to the works manager to plant manager, Industrial Crane & Hoist, Ingersoll Products Division of Borg-Warner Corp.

Gerson Lewis has been elected vice president of Loral Electronics Corp, New York. Also made vice presidents: **Thomas J McLaughlin, A Gerald Merlin**, and **Sheldon Simon.**

W Gerald Lanterman has been appointed manager of sales of the Industrial Division of Lamson Corp, Syracuse, NY, manufacturer of conveyors and pallet loader systems. He was formerly Cleveland regional manager.

Gene Lowe has been named vice president, manufacturing, at Benson-Lehner Corp, Los Angeles manufacturer of data reduction equipment.

John F Cachat has been appointed works manager of Ohio Crankshaft Co's Tocco Division. He has been serving as Cleveland district manager.

Louis E Dondero has been named manager of the West Allis plant of the Le Roi Division of Westinghouse Air Brake Co, Milwaukee. Formerly manager of L-R's Cleveland Rock Drill plant, he succeeds **Hugh M Little.**

Marx L Kristek has been named manufacturing manager of the Plymouth assembly plant in Detroit. He was manager of final assembly operations of the Buick plant in Flint before joining Plymouth last March.

Joseph C Duke, a vice president of Minnesota Mining & Manufacturing

Co, has been elected executive vice president in charge of coated abrasives, adhesives, and coatings. **Bert S Cross,** also a vice president, has been made executive vice president in charge of graphic products.

William H Welch has been elected president of Sleeper & Hartley, Inc, Worcester, Mass, manufacturer of spring making machinery. **Richard S Russell** has been named vice president, production.

R D Rowley has been appointed manager of the Westinghouse metals plant at Blairsville, Penna. He has been serving as manager of wrought alloy manufacture there. Mr Rowley succeeds **Warren M Trigg,** named manager of the company's motor department at the motor and control division, Buffalo.

Richard T Kropf, vice president and director of research for Belding Heminway Co, New York, has been elected president of the American Society for Testing Materials. **F L LaQue,** a vice president of International Nickel Co, and manager of its Development and Research Division, has been named ASTM vice president.

S C Amren has been appointed vice president, manufacturing, of Charles Bruning Co, Chicago maker of engineering and office reproduction machines.

Robert F Moody, eastern division sales manager for Hyster Co industrial trucks at Danville, Ill, has been appointed domestic sales manager in charge of all industrial sales activities.

S O Drivdahl, sales manager of the Rochester, NY, office of Scovill Manufacturing Co, Waterbury, Conn, has been named regional sales manager of the General Manufacturing Division and the Forging and Screw Machine Division.

Edward M Van Winkle has been appointed general manager of the Magnus Metal Division of National Lead Co, succeeding **John P Borda,** who has retired. Mr Van Winkle continues as president of Magnus Metal Corp, an NL subsidiary.

Lester J Henderson, formerly general sales manager of the Special Products Division of Weatherhead Co, has been appointed vice president, sales, for Republic Manufacturing Co, Cleveland valve manufacturer.

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Simple or complex metal forms in wire or ribbon metal is no problem on a Nilson. Tooling for basic forming can be augmented by provision for operations such as welding, assembling or swaging. Open design on all forming elements provides for quick tool change and easy adjustment even from wire to metal forming on the one machine that does so many jobs so well. The universal Nilson 4-Slide is the economical answer to your forming problems. Size ranges—wire up to ½" dia. in feeds to 32" max., ribbon stock up to 3½" wide. 5 to 75 ton press sections. Our specialists can assist you in all types of forming requirements.

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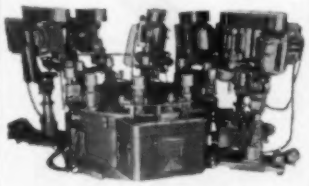

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Bulletin 61-105 describes the Sperry Bearing Tester. Write for your copy.

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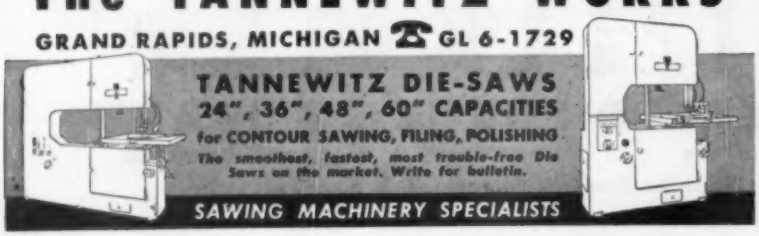

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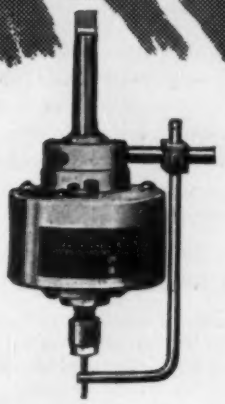

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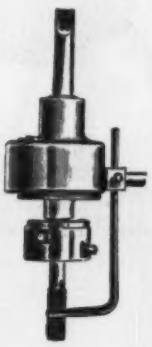
Designed for Ball Bearing High Speed Drill Press.



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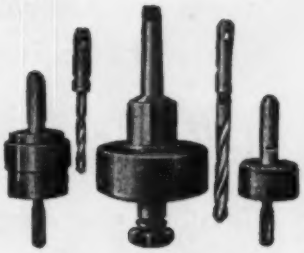

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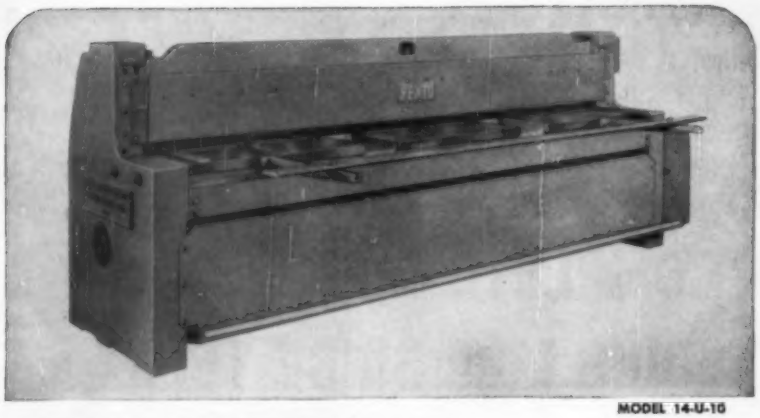

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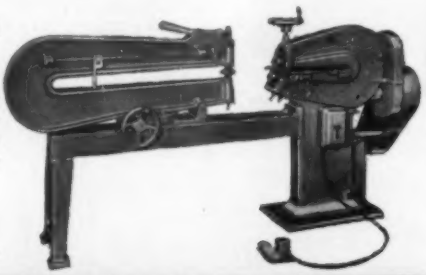

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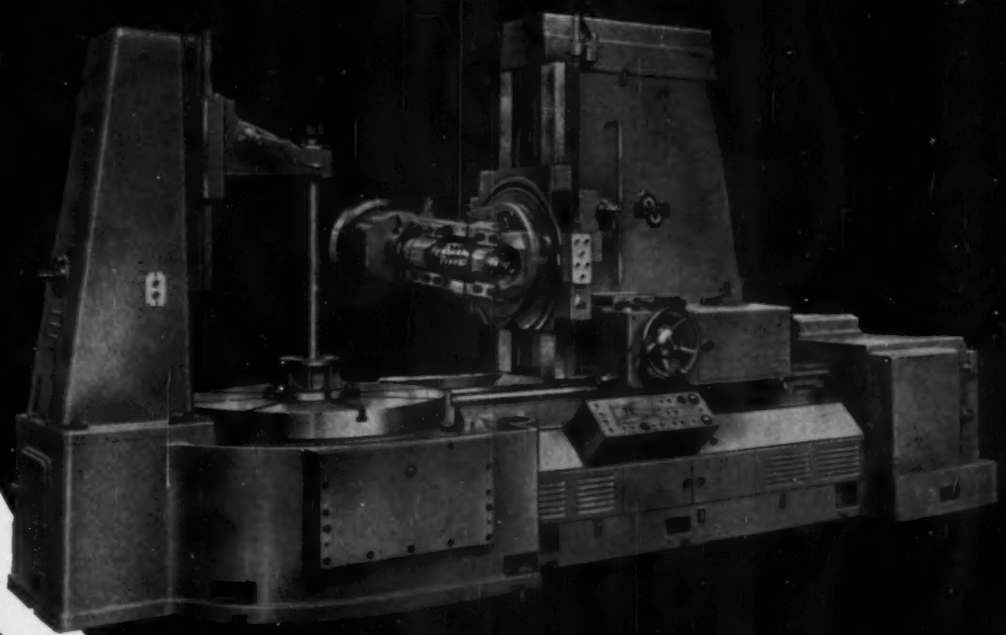

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FS-1200

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Gaging . . .

the Surplus Machinery Market

•**We've been looking around desperately for a bright spot** somewhere in the used machinery business picture, but from the rock-bound coast of Maine to the sun-kissed shores of California business is slow, slack, or even "dead."

Most dealers we have talked to recently are at a loss to find specific reasons for the lull. Generally, they think it's a two-way squeeze between tight money and a seasonal leveling-off in manufacturing activity. These factors in turn are producing a "wait and see" attitude on the part of potential buyers of used machinery and, for that matter, new machinery.

Several dealers report that inquiries for big machine tools, such as large boring mills, are strong, but these machines are hard to come by. "If we could get some, we could make some money," one dealer told us.

One Cleveland outfit reports that its total volume is off about 20% from the same period last year, but that inquiries on larger machines are holding up well even on old models.

This company says that uncertainty among its customers as to the general manufacturing outlook has brought on the customary July-August sales slump ahead of time.

However, this company's rebuilding business is up 10 to 15% from the same period last year.

This could be an indication that many companies are planning to ride with their old machine tools for a while. As a matter of fact, this Cleveland dealer is whittling down on his inventory of old machinery to make room for more contract rebuilding jobs—this outfit reports its rebuilding business is the best it's been since Korea.

Bearing out reports that big machines are the best sellers today is one big Midwestern outfit, which says that it sold three turret lathes last month that it had bought three years ago and had been stuck with since that time.

•**Out on the West Coast,** where the aircraft industry calls the shots, sales volume has been on a gradual decline for the last six weeks or so, with most dealers estimating business off from 15 to 20%.

One West Coaster says he's noticed a steady drop each year in used machinery business during the tax period. He says its getting more pronounced every year out on the West Coast, where he feels the government ought to increase its contracts to bring the money paid out at tax times back into circulation in the area.

The defense cutbacks, and to some extent the defense overtime cutbacks, are beginning to make themselves felt out in the Los Angeles area. Dealers feel that until the cut-back defense work is reinstated and more government work pours into the area, they won't see an improvement in business.

Demand for good used heavy equipment, as elsewhere across the country, is hot on the West Coast, but there is no particularly heavy demand for any one item.

Older machines and tools are becoming harder and harder to sell out there—a condition that has become increasingly pronounced during the last year.

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BRAND NEW
CYRIL BATH
(STURDYBENDER)

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#100-10	10' x 8 GA.	12' Bed
#120-10	10' x 3/16"	12' Bed
#150- 8	8' x 5/16"	10' Bed
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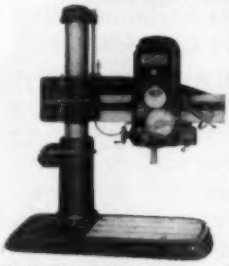

3'11" column American Holewizard Radial Drill, motor on head, 12 speeds, late type.

4'11" column American Holewizard Radial Drills, motor on head, 12 speeds, late type.

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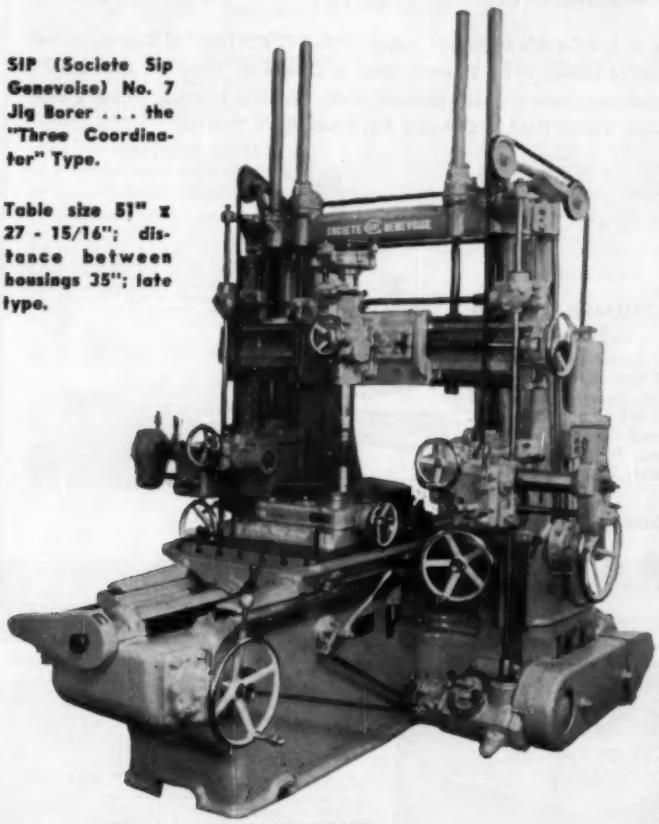

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5" bar SELLERS, table type; late type
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3" bar UNIVERSAL; late type

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AMERICAN 4' arm 11" col. Triple Purpose
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#1 Surface Hardener; late type.
3" Straight Bevel Gear Generator; 4-7/16" P.D., 8 D.P.; late.
3" Spiral Bevel Gear Generator; 4-7/16" P/D.; 12 D.P.; late.
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BARBER COLMAN Type A; cap. 12"x12"; 3 D.P.; with differential; late
BARBER COLMAN Type S Auto.; 1" dia., brass 24 D.P., steel 32 D.P.; late.
BARBER COLMAN Type T, 12"x12" cap., 3 D.P.; with differential; late.
BARBER COLMAN #17, cap. 8"; 2½ D.P.; 5¾" hole thru spindle; M.D.
GOULD & EBERHARDT #8H Univ.; cap. 12"; 4 D.P.; heavy duty; M.D.
GOULD & EBERHARDT #24H Univ.; cap. 27"; 3½ D.P.; late type
GOULD & EBERHARDT #24H Univ.; extended hob spindle.
NEWARK #5 for helical, worm wheels & spur gears.

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AMERICAN 48"x48"x10' double housing.
NBP 36"x36"x14' double housing.
NBP 72"x72"x30' double housing.
DETRICK & HARVEY 48"x48"x16' with hydraulic table feed with oil gear unit, with hydraulic clapper box lifts.
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LIBERTY 144"x76"x48' Openside.
SELLERS 48"x48"x7' double housing.

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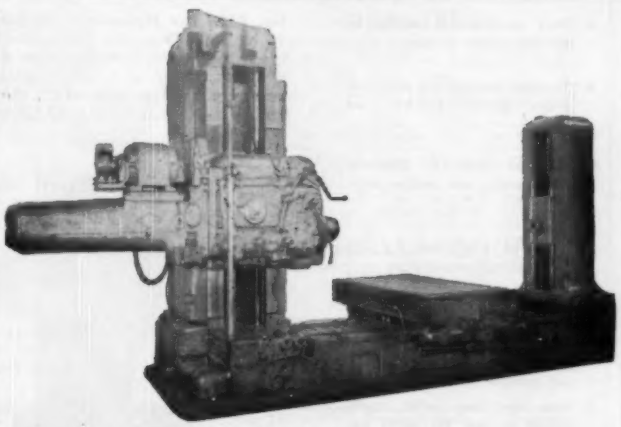
GOULD & EBERHARDT 24" Horiz.; M.D.
GOULD & EBERHARDT 32" "Invincible"; Horib.; M.D.
HENDEY 12" Univ. Horiz.; high speed; late type.
NEWTON 15" Ver. Slotter; motor drive.
NBP 30" Slotter; crank type; late.
POTTER & JOHNSTON 24" Univ. Shaper; late.
PRATT & WHITNEY 6" & 10" Ver. Shaper; M.D.
ROCKFORD 36" Openside Shaper; Hyd.; late type.
STEPTOE 14" Horiz. Shaper; M.D.; late type.
STEPTOE 16" Shaper; late type.

MILLING MACHINES—THREAD

EXCELLO #33 Thread Grinder; helix angle of wheel 20° in either direction.
EXCELLO #35-L Univ. Precision Thread Grinder; late type.
FELLOWS #4T Thread Generator; cap. 4"x18" cc; 5 D.P.; late.
HALL Style B Planetary Mill & Thread Mill; max. dia. 6"; late.
HANSON & WHITNEY 8"x16" cc Univ.; late type.
LANDIS #8 Thread Grinder; 12"x24".
LEES BRADNER Model LT—6"x72" cc; late.
LEES BRADNER Model HT—12"x24" cc; late.
MOREY 12"x30"; 12"x120"; 12"x160"; 12"x190" cc; late.
PRATT & WHITNEY Model 1804 4½"x12" cc; late.
PRATT & WHITNEY 6"x132" cc; all geared head.
WALTHAM—max. center distance 12".



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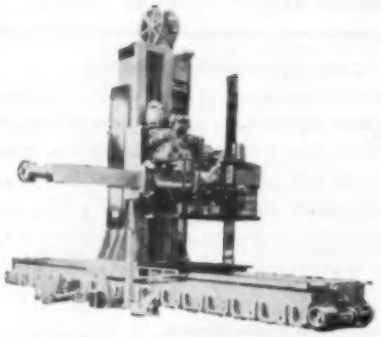

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Serial No. 1211

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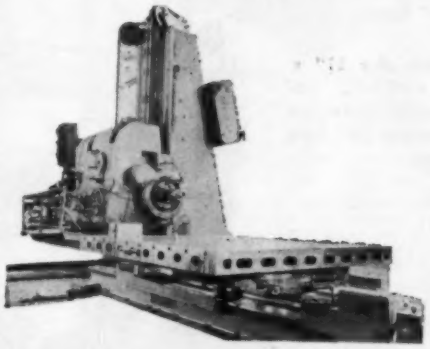

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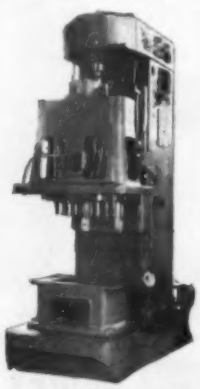

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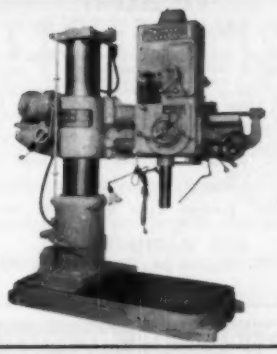

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No. 1-14 KENT-OWENS Hydraulic Prod. Mills M.D., Late Type.

No. 4 CINCINNATI Hi Power Vert. Mill, 1942.

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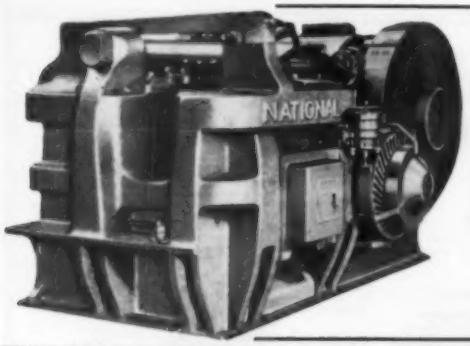

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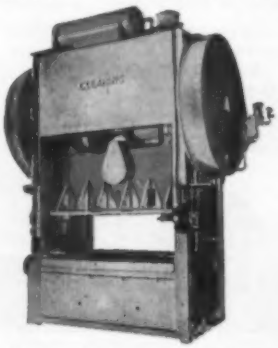

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3L Gisholt Turret Lathe, cross sliding turret, 1941
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(3) No. 3 Warner & Swasey Turret Lathes, Bar Feeds, late
No. 2 Cincinnati Dial Type Plain HI-Speed Horiz. Mill, late
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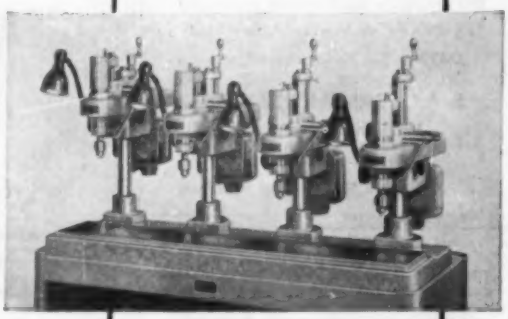

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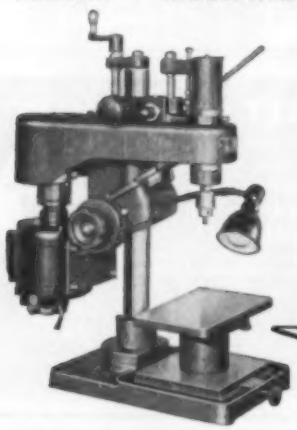

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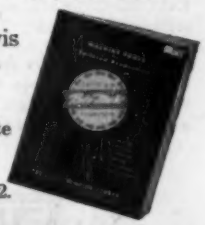

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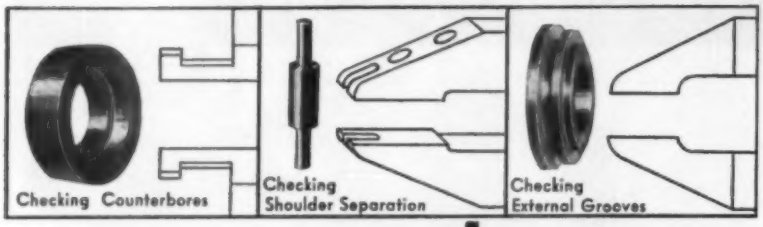

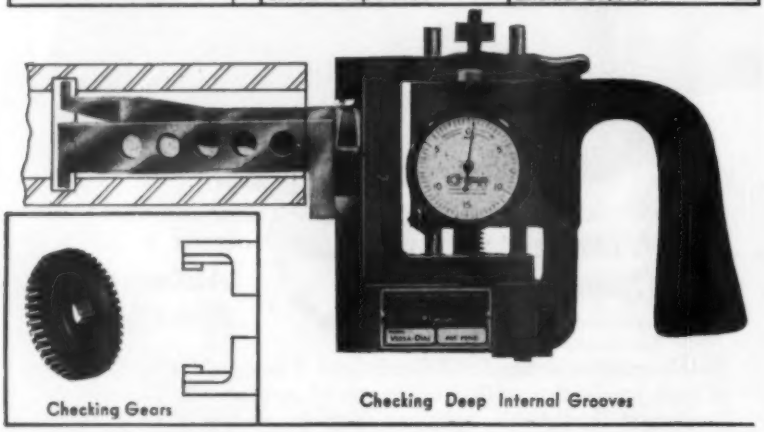

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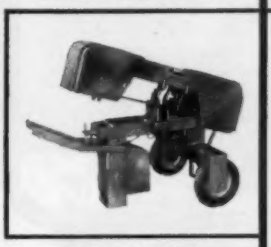

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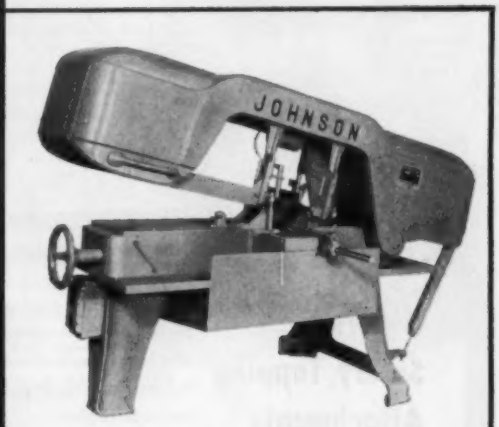

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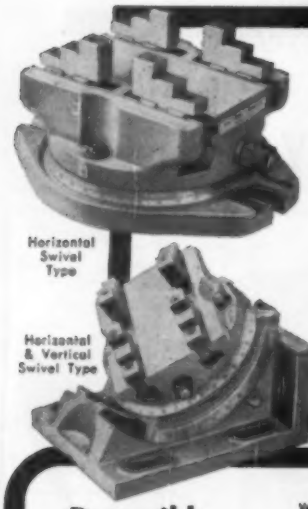

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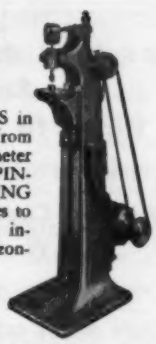

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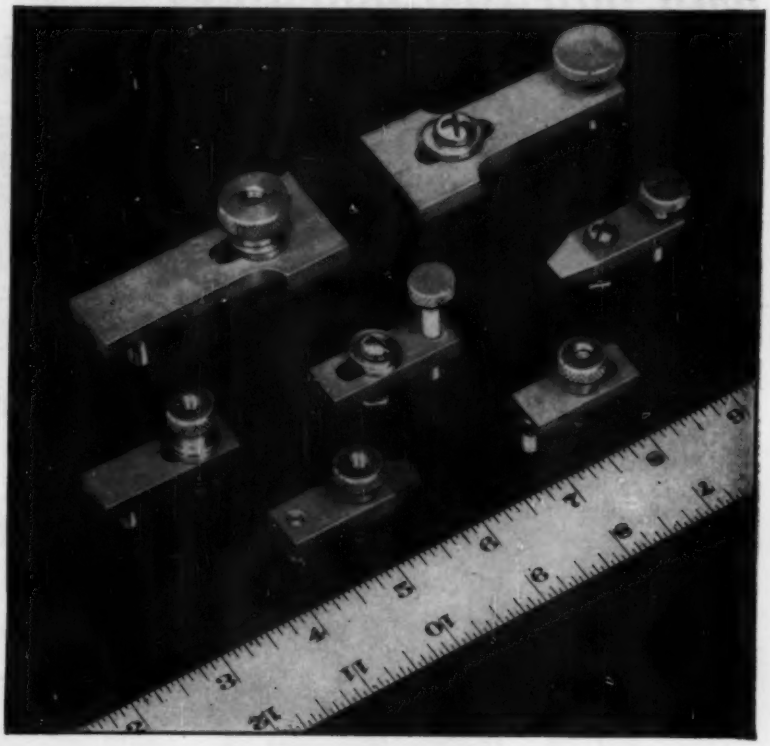

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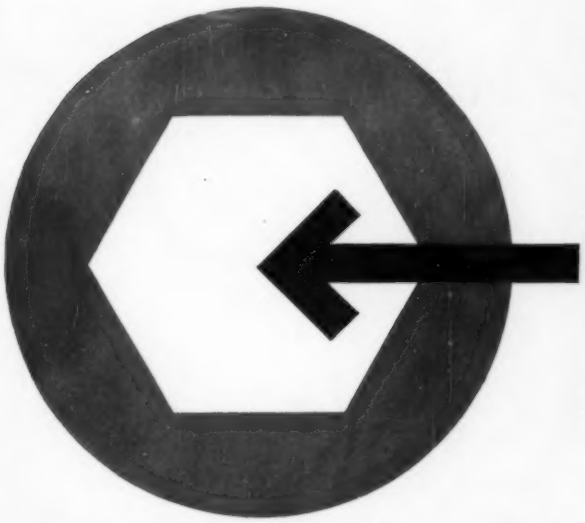

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FACT 1 Holo-Krome Socket Screws are far tougher than you might think. Their sockets easily withstand at least 50% more torque than can be exerted by a hex key in ordinary hand-tightening.

FACT 2 Power tool tightening is different. Then tightening force depends on the torque of the driving tool, strength of the bit, and the inherent toughness of the socket. H-K sockets are guaranteed to give unfailing performance.

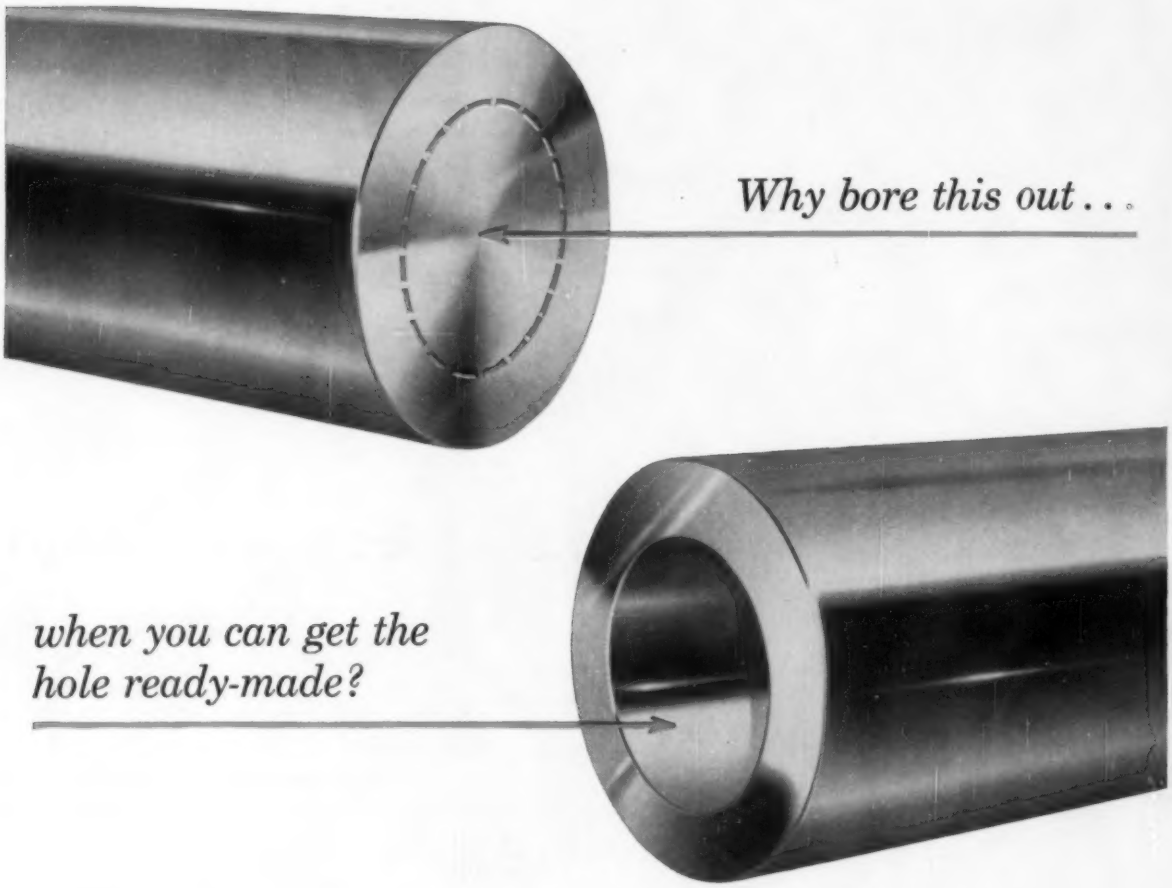
FACT 3 Holo-Krome sockets have sharp hex corners, untapered socket walls, socket depth scientifically proportioned, continuous metal fibers reinforcing the socket wall.

Your best insurance against socket screw failure is H-K's exclusive forging method. For the toughest in socket screws—and hex keys—look to Holo-Krome!

HOLO-KROME

THE HOLO-KROME SCREW CORP., HARTFORD 10, CONN.

Sold only through authorized Holo-Krome distributors.



Save money on hollow parts by switching from bar stock to TIMKEN® seamless steel tubing

Check these savings you get when you make hollow parts with Timken® seamless steel tubing instead of bar stock:

1. **NO HOLE TO DRILL**—it's already there.
2. **ELIMINATION OF COSTLY BORING OPERATION** frees part of your screw machines for other jobs—adds machining capacity *without* adding machines.
3. **MORE PARTS PER TON OF STEEL** because there's less metal to hog out.

And with Timken seamless steel tubing you get better quality finished products. The piercing operation by which Timken seamless steel tubing is made gives the tubing its fine forged quality. A solid round is forged over a mandrel, thoroughly working the metal inside and out. Accurate temperature and piercing speed control combine to produce uniform, fine forged quality. And we maintain this quality from tube to tube, heat to heat, order to order.

Timken Company engineers are always ready to study your problems, recommend the most economical tube size for your hollow parts job—a size guaranteed to clean up to your dimensions. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN *Fine Alloy* **STEEL**

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SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING